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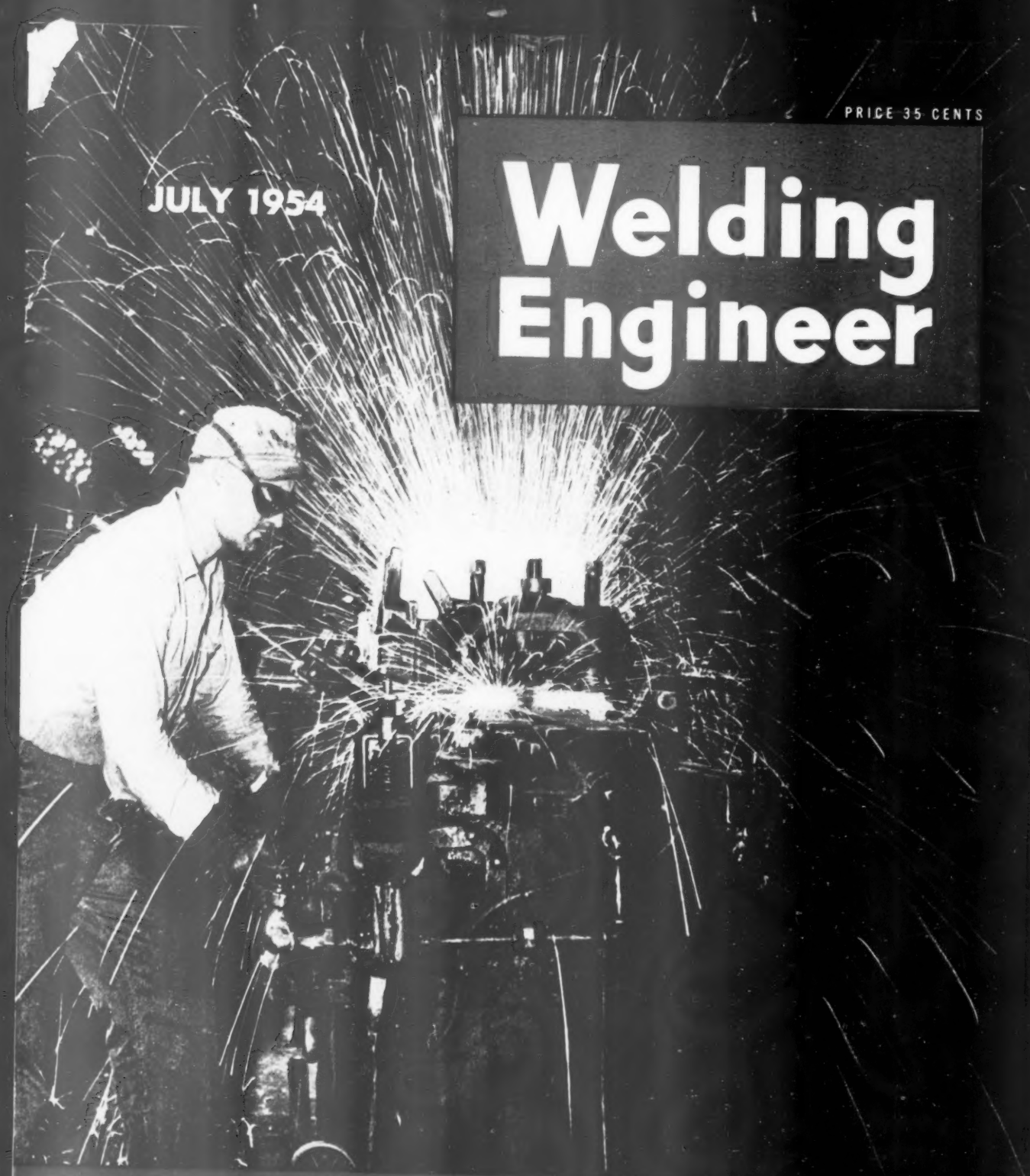
JULY 1954

Welding Engineer



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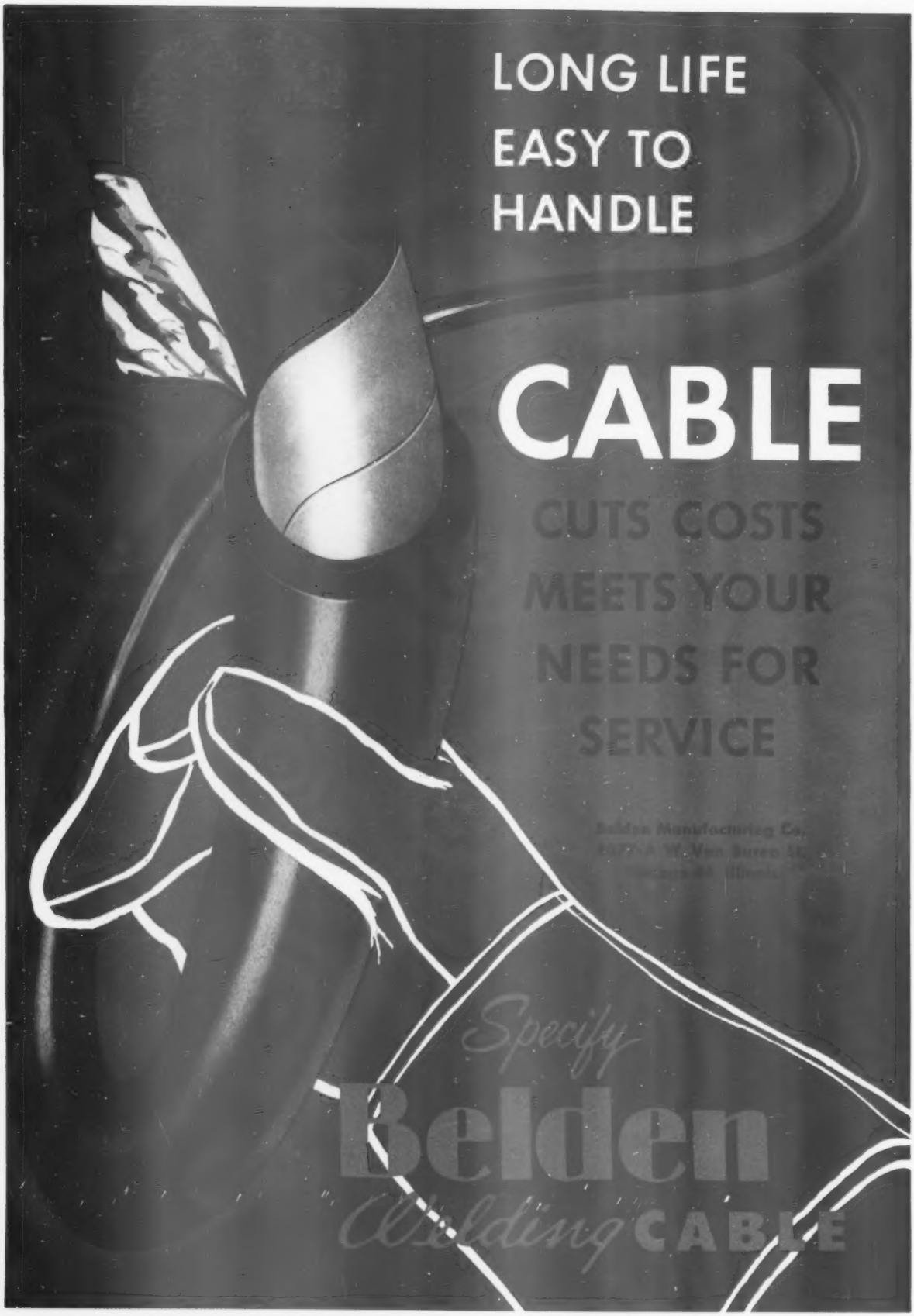
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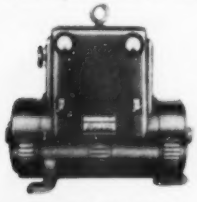

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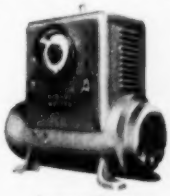

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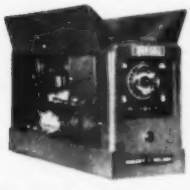

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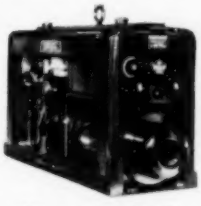

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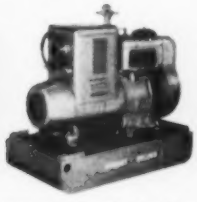

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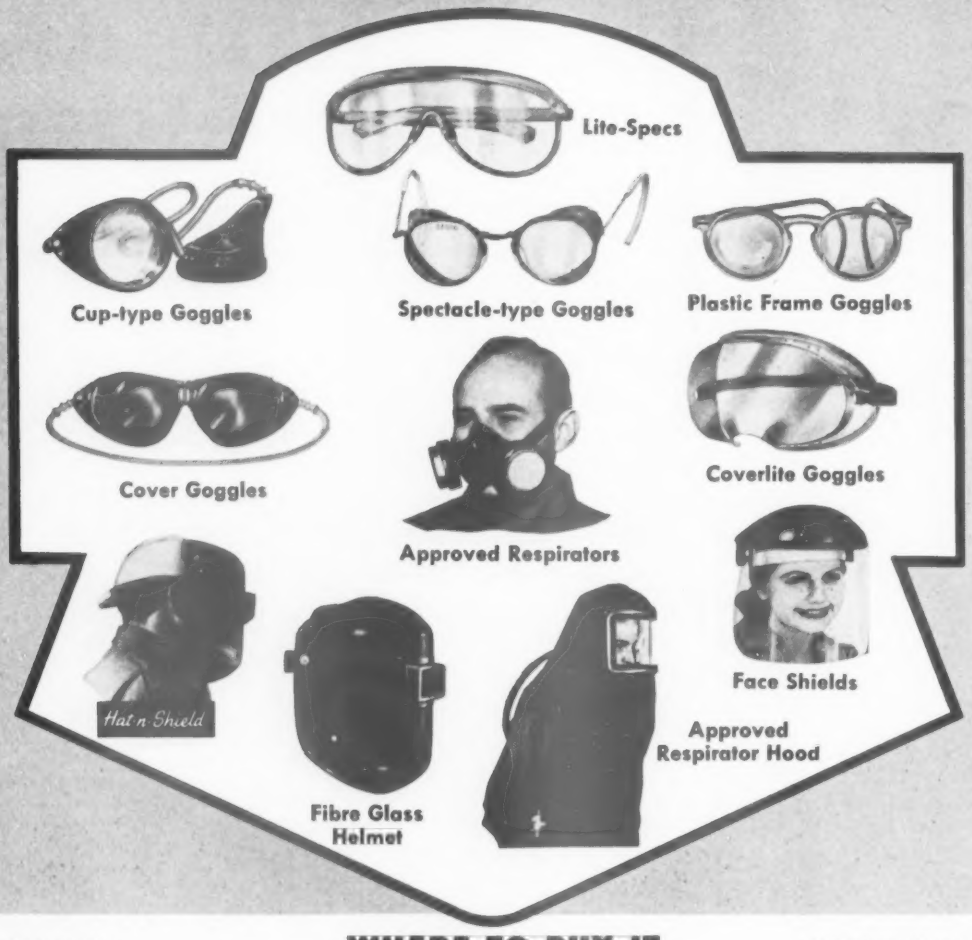

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VOLUME 39 NUMBER 7

Welding Engineer

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WELDING ENGINEER • JULY • Vol. 39—No. 7

(with which is combined The Acetylene Journal)

Members: American Welding Society
International Acetylene Ass'n.
National Welding Supply Ass'n.

Published monthly, with an additional directory number in June, by McGraw-Hill Publishing Company, James H. McGraw (1860-1948), Founder. Publication Office: 871 North Franklin Street, Chicago 10.

Executive, Editorial and Advertising Office: McGraw-Hill Building, 330 W. 42nd St., New York 36, N. Y. Donald C. McGraw, President; Willard Chevalier, Executive Vice-President; Joseph A. Gerardi, Vice-President and Treasurer; John J. Cooke, Secretary; Paul Montgomery, Executive Vice-President, Publications Division; Ralph B. Smith, Vice-President and Editorial Director; Nelson Bond, Vice-President and Director of Advertising; J. E. Blackburn, Jr., Vice-President and Director of Circulation.

Subscriptions: Address correspondence to J. E. Blackburn, Jr., director of circulation, Welding Engineer, 871 North Franklin St., Chicago 10, Ill., or 330 W. 42nd St., New York 36, N. Y. Allow one month for change of address. Subscriptions are solicited only from executives, engineers, technicians and supervisory personnel in plants engaged in production or maintenance welding processes. Position and company connection must be indicated on subscription orders.

Single copies 35c. Subscription rates—United States and possessions $3 a year; $4 for two years; $5 for three years. Canada $5 a year; $8 for two years, and $10 for three years. All other countries $15 a year; $25 for two years; $30 for three years. Entered as second class matter Aug. 23, 1948, at the Post Office at Chicago, Ill., under Act of Mar. 3, 1879. Printed in U.S.A.
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WELDING ENGINEER is indexed regularly by Engineering Index, Inc.

JULY, 1954

Cover: A flash welder casts a shower of fireworks at the Johnstown-Lorain Works of U.S. Steel, Johnstown, Pa.

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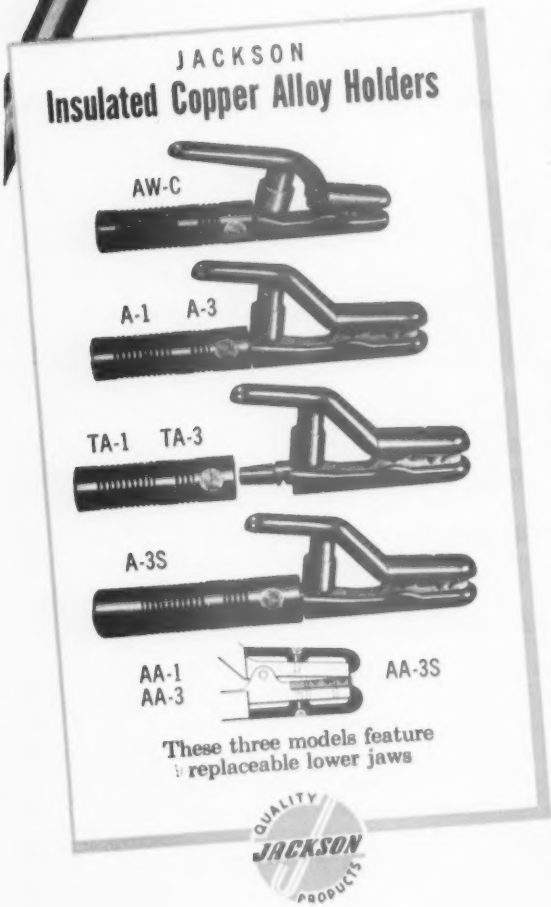
Duty-Cycle Rated for Top Production



In today's competitive race for stepped-up production, we see new welding machines and new electrodes coming on the market, all designed to do the work easier and faster.

Therefore, in choosing the right electrode holder for a job, don't think of *rod size* alone. We must equally consider *amperage* and *cable size*, and today, more than ever, the required *number of electrodes per hour*. These four factors combined establish the *duty cycle*, that is the percentage of actual arc-time in any ten-minute period of work.

The following table shows the duty cycles possible with the various *Jackson Insulated Copper Alloy Holders*, based on using the largest rods and cables these holders will take, operating at each holder's rated amperage.

Holder Class	Model Number	Electrode Size	Rated Amperage	Cable Size	Duty Cycle
SMALL	AW-C	7/32″	250	1	50%
MEDIUM	A-1, AA-1 TA-1	1/4″	300	1/0	50%
LARGE	A-3, AA-3 TA-3	3/8″	500	3/0	50%
HEAVY-DUTY	A-3S	3/8″	500	3/0	65%
	AA-3S	3/8″	500	4/0	80%

This table will help you in making the right selection from these Jackson copper alloy holders. Using a superior 98% copper alloy heat treated for greater strength, hardness and conductivity, these holders permit highest duty cycles with ample margin of safety.

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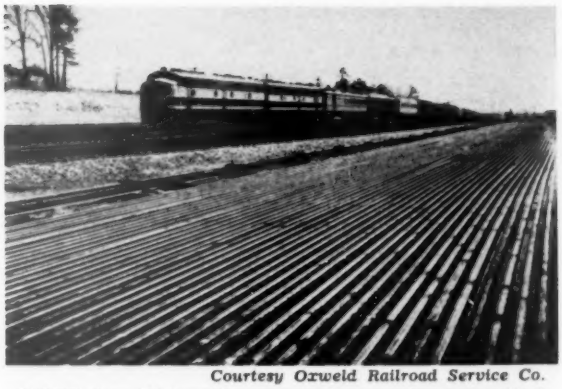
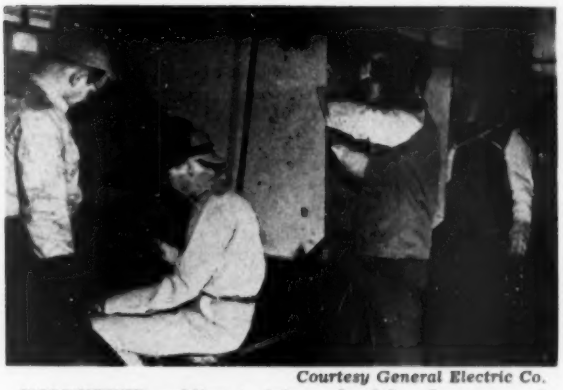


Courtesy Oxweld Railroad Service Co.

MORE than 50 lengths of snake-like continuous welded rail, each piece over 1,000 ft long, rest alongside mainline of Richmond, Fredericksburg and Potomac Railroad, near Richmond, Va. These long rails, produced by welding together many standard rail lengths, are being used by the railroad to replace older track with joints



Courtesy General Electric Co.

VOLUNTEER welding training school has been started by G-E's Locomotive and Car Equipment Department. It is open to anyone in the department wishing to learn special welding techniques or acquire practical welding experience. The department thus hopes to solve problem of obtaining qualified weldors and additional supervisors

NEWS

Pandjiris names judges for essay contest

THREE judges for the positioned-welding essay contest, sponsored by The Pandjiris Weldment Co., St. Louis, were named at the recent American Welding Society meeting in Buffalo. They are: Howard N. Simms, of Black, Siwalls & Bryson, Inc., Oklahoma City; J. J. Powers, of Midvale Co., Philadelphia; and E. J. Hornack, of Sunbeam Corp., Chicago.

The contest closes Aug. 15.

* * *

ASTM, AWS issue copper electrode specifications

FIVE types of copper and copper-alloy, covered and bare electrodes are described in the new edition of "Tentative Specifications for Copper and Copper-Alloy Welding Electrodes" issued jointly by the American Welding Society and American Society for Testing Materials.

The new edition was prepared primarily to standardize the electrodes used in Mig (metal inert-gas) welding. Copies of the specifications (AWS designation A 5.6; ASTM Designation B 225) can be obtained at 25 cents each from either society—AWS, 33 W. 39th St., New York City 18; ASTM, 1916 Race St., Philadelphia 3.

Both societies also have announced the publication of "Tentative Specifications for Corrosion-Resisting Chromium and Chromium-Nickel Steel Welding Rods and Bare Electrodes," ASTM Designation A 371-53T; AWS Designation A 5.9-53T. These cover stainless-steel filler metals for use with the Mig and Tig (tungsten inert-gas) processes. Rods are for use with the atomic-hydrogen and Tig methods; bare electrodes are used with submerged-arc and Mig methods.

Copies of this booklet are also available from either headquarters at 25 cents each.

More on titanium

Industry is continuing to demand a weldable alloy titanium sheet. To date, about 50% of the industry is hot forming and 50% is cold forming titanium with equally excellent results. One of the newest alloys brought out by research is one that develops 196,000 psi at temperatures up to 750 F before strength fades. To date, there have been developed nine commercially pure forms of titanium and 13 alloys. These are actually in production and are being sold and used to varying degrees. The newest contains 5% aluminum and 2.5% tin.

Reed Engineering becomes part of The Webb Corp.

THE Webb Corp., Webb City, Mo., has been licensed to manufacture, sell and distribute the line of welding fixtures and metal-forming equipment formerly built by Reed Engineering Co., Carthage, Mo. These products will be offered through Webb distributors. The Reed line will be manufactured by the Reed Equipment Division of The Webb Corp.

The L. H. Knost Co., of Carthage, headed by the former president of Reed, L. H. Knost, will be retained by Webb as consulting engineers for the design of new machines and fixtures for the plate-fabricating field.

* * *

Liquid Carbonic to build plant in Houston

ANNOUNCEMENT was recently made by The Liquid Carbonic Corp., Chicago, that it will build a large new carbon dioxide plant in Houston to be located on the ship channel. At present, the firm has carbon dioxide plants in Houston and Dallas as well as 24 other plants located throughout the country. The industrial growth of Texas was cited as reason for construction of the new plant.

* * *

Westinghouse man named president of ASTM

NORMAN L. Mochel, manager of metallurgical engineering for Westinghouse Electric Corp. in Philadelphia, was named president of American Society of Testing Materials for 1954-55 at the group's annual meeting last month in Chicago.

NEWS

from page 5

Courtesy Bethlehem Pacific Coast Steel

AFTER one H-pile is gunited, another is welded to it and gunited, making an overall length of 115 ft. Corrosion and fireproof piles were driven into bay for wharves on Pacific Coast by Gen. Ben C. Gerwick, Inc. Keeping process under strict control resulted in gunite being able to withstand 5,000 lb of pressure

Courtesy Caterpillar Tractor

MAKING quick determination of alloys in metals by using spectroscope is one phase of work done in metallurgical laboratory at Caterpillar Tractor Co.'s new plant at York, Pa. The laboratory has also been provided with other equipment for quick and accurate tests of steels and non-ferrous products, including hardness testers

Airco takes over Colton Chemical Co.

SUBJECT to approval of its stockholders, The Colton Chemical Co., Cleveland, was recently acquired by Air Reduction Co., Inc., New York City. The assets and business of the chemical firm were acquired by Airco in return for Air Reduction common stock. It is anticipated that the chemical company will operate as a division of Airco with headquarters remaining in Cleveland and that the Colton organization will be kept intact.

* * *

Conference for engineers held at Ohio State

ABOUT 600 alumni, faculty, students and guests attended the first annual Conference for Engineers at Ohio State University in May. Meetings and open houses were held by the various engineering departments, including the department of welding engineering. Speakers at the one-day conference were Admiral Hyman G. Rickover, who is considered the father of the atomic submarine, and Dr. Charles F. Kettering, famous inventor and engineer.

* * *

3-day clinic by Whitehead draws eastern industry

ALL welding processes covering almost all metals were demonstrated at the welding clinic conducted by Whitehead Metal Products Co. in its new Philadelphia warehouse on May 25-27. The clinic was different from most in that it was more than a product exhibit.

Five different films were shown at hourly intervals. Included in the live demonstrations were a new hot-air, gun-type tool used in welding plastic, a dip-coating process used on aluminum, inert-gas welding, hardfacing and sandblast metal cleaning.

* * *

United Wire displays products in RR station

A BOOTH 4-ft square in the Providence, R. I., railroad station is being used to good advantage by United Wire and Supply Corp. of that city. Nine samples of wire in coil and spool form have been placed in the booth with typical end products shown for each. A chart tells the public about some of the firm's other products, including brazing alloys and fluxes. Customers, coming to the city by train, have commented favorably on the exhibit, and United Wire feels the small expense involved in setting up the booth has been well justified.

* * *

New sales division for "Bren/Weld" equipment

KASSON Die & Motor Corp., Long Island City, N. Y., is now the sales division for Brennen, Bucci & Weber Co., New York City, manufacturer of "Bren-Weld" industrial welding equipment. The firm will shortly launch a full line of butt, arc and spot welders, according to a recent announcement.

NWSA announces dates for zone meetings, convention

NATIONAL Welding Supply Association has announced the dates for its 1954-55 zone meetings and its 1955 convention. The eleventh annual convention will be held at the Edgewater Beach Hotel, Chicago, on May 18 through 20, 1955.

Zone meetings:

Central zone—Sept. 16-17, Hotel Cleveland, Cleveland. Eastern zone—Sept. 20-21, Sheraton-Plaza, Boston. West Central zone—Nov. 15-16, Hotel Fontenelle, Omaha. Southeastern zone—Dec. 6-7, Dinkler-Tutwiler, Birmingham. Southwestern zone—Dec. 9-10, Hotel Skervin, Oklahoma City. Western zone—Feb. 10-11, Fairmont Hotel, San Francisco.

Also announced was an informal luncheon to be held at the Hotel Sherman during the Metal Show in Chicago this fall.

* * *

TV film tells role of welding in engineering feat

ONE of the most spectacular engineering feats of modern times—construction of a waterfall and electric power plant inside a mountain—is portrayed in the "Better Living Television Theater" film series, being telecast on a delayed basis by local stations affiliated with the DuMont television network.

"More Power For Rio," a feature film, depicts the "Forcacava Project" of Rio de Janeiro Tramway Light & Power Company, Ltd., of Rio de

(Continued on page 73)

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The beautiful new DC-7 UNITED MAINLINER now placed into transcontinental service by UNITED AIR LINES represents the best money can buy; every minute detail for the travelers' safety, comfort, pleasure and swift transportation has been incorporated into this speedy plane. Its cost is about $1,750,000. Each individual turbo-compound engine, and there are four of them, costs some $65,000.00 and they offer the traveler a cruising speed of 365 mph. We are proud, indeed, that our company's regulators were selected a component of such an outstanding selection of construction parts as comprise this marvelous product of the engineering and construction genius of the Douglas Aircraft Company. You, too, are fully justified to place your confidence in these fine pressure regulators which today serve the most critical buyers.

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Typical Fillet Speeds

Electrode Size	Amps., AC	Fillet Size	Speed, in./min.
3/16"	290	1/4"	15
7/32"	325	5/16"	15
1/4"	395	3/8"	15

Deposition Rates

DH-5 Electrode Size	DH-5 Amps.	DH-5 Deposit #/hr.	E-6012 Deposit #/hr.
3/16"	250	6.8	4.5
3/16"	280	7.9	
3/16"	320	9.6	
7/32"	300	9.0	5.8
7/32"	340	10.1	
7/32"	380	12.0	
1/4"	350	11.2	7.0
1/4"	400	12.8	
1/4"	450	14.7	

Try to match this for

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Deposits up to twice as many pounds per hour as an E-6012

That's right, the DH-5 is in a class by itself, when it comes to high welding speed and sound deposits in horizontal and flat positions. It's Harnischfeger's answer to the demand for lower welding costs. It's your answer to the need for faster, better work.

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Wherever they've tried it, weldors like the DH-5. It's fast, it's easy to use. There's no splatter. Slag removal is easy and quick. The bead shape is flat and smooth.

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Yield strength - - - -	73,000-77,000
Elongation in 2" - - - - -	15-25%

If you're interested in your cost picture — and who isn't, today?—you owe it to yourself to try the DH-5 without delay. See your P&H representative or distributor now.

For further facts, write for bulletin.

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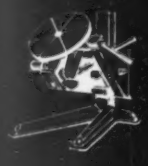

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P&H WN-250 ENGINE-DRIVEN ARC WELDER

NEMA-rated at 200 amps, but pulls 300 amps. Has full 20-gallon gas tank — runs all day on one tankful. Powered by four-cylinder, 180 GLU, Waukesha, water-cooled gasoline engine.

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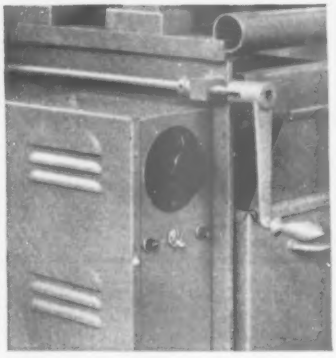

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Proved by years of field use

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Developed and field tested, the world over, for more than four years, it is now available through Amsco Distributors. (Amsco purchased the Leader Manufacturing Company late in 1953.) It joins a proved line of automatic and manual welding rod, electrode and manganese steel shapes long recognized for their part in the fight on the problem of wear.

In fact, the addition of the Amsco Leader line now gives Amsco Distributors the most complete line of hardfacing and wear-resistant materials on the market today. A fact that will mean cost savings to you the sooner you get acquainted with the Amsco Distributor in your town.

Call him today. Make a date to see the great, new Amsco Leader automatic electric welder. Ask him for your copy of the Amsco Leader folder, giving complete description and specifications of this versatile machine.

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Chicago Heights, Illinois

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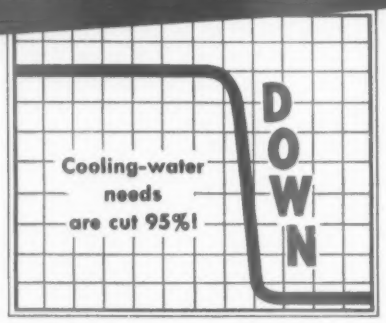

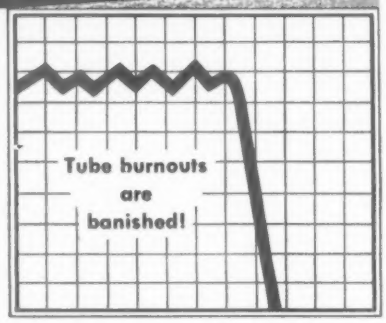

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Also available are *new GL-6346,* Size B, will replace GL-5551/FG-271 . . . and *new GL-6348,* Size D, will replace GL-5553/FG-258-A.

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● 14 G-E ignitrons in all—8 for welding, 6 for power rectification—mean that your tube needs will be closely met, no matter what type or size you are replacing. Superior performance is built into every G-E ignitron, to an extent where the history of the ignitron tube is written in General Electric design improvements . . . latest of these, the new Temperature-controlled Series.

GENERAL ELECTRIC

161-184

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"Home made" resistance welding electrodes can be expensive—not only because of the time they cost but also because of limited strength, poor conductivity and inadequate cooling.

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Figure 1. Lincoln INERTARC . . . *New development in quality welding with inert gases. Current range . . . 10 to 350 amps. Can be changed over for conventional AC welding in 2 minutes.*

LINCOLN INERTARC

. . . for high quality, low-cost welding with inert gases

Simplifies Operations. With INERTARC, the arc starts whenever the electrode comes within one-half inch of the work and the arc strike button is depressed. Danger of contamination by touching the electrode to the work is eliminated. Life of electrode is prolonged by accurately timed control of inert gases and cooling water.

Speeds Welding. High responsiveness to changing arc conditions provides steady arc with maximum ease . . . maximum speed of welding without sacrifice of quality on aluminum, non-ferrous and on stainless steel fabrications when AC is specified.

New Safety for Operator. Open circuit voltage on the holder remains at zero until the "start" button is depressed. With INERTARC, there is no continuous high frequency or high voltage for arc starting or welding.

Meets Requirements of F.C.C. for non-interference with radio and TV reception.

DUAL PURPOSE WELDER — INERTARC is easily changed over to conventional AC welding with coated electrodes. Changeover takes 2 minutes.

Send for Bulletin. **Complete description and specifications of Lincoln INERTARC are in Bulletin 1329. Available by writing on your letterhead to**

DEPENDABLE PERFORMANCE AT LOW COST

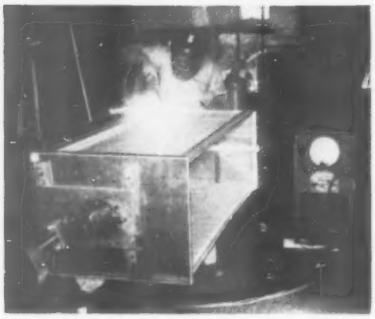

Figure 2. Speeds Fabrication *of utility cabinets from 2-S and 3-S aluminum to cut production costs.*

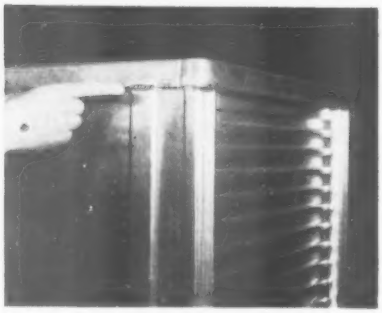

Figure 3. Improves Quality *by producing solid, smooth welds with minimum discoloration to parent metal. Photo shows bead as welded.*

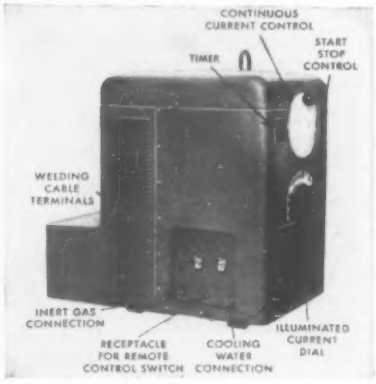

Figure 4. Simple to Install. *Connections for welding cable terminals, cooling water and inert gases are housed in recess at side of machine. Illuminated current dial indicates when welder is turned on.*

THE LINCOLN ELECTRIC COMPANY

Dept. 1706

CLEVELAND 17, OHIO

THE WORLD'S LARGEST MANUFACTURER OF ARC WELDING EQUIPMENT

ESTABLISHED 1916 **Welding Engineer** JULY, 1954

All metals are weldable if—

WITHOUT metals, we would still be in the stone age, and civilization could never have arisen. And welding belongs as inseparably to metals as ham to eggs or liver to bacon.

All metals are weldable . . . *if* you use the proper process and proper techniques. Difficulties in welding some metals are often due merely to improper diagnosis. The Kettlehead type who proclaims in a loud voice that a certain type of material is not weldable is speaking from ignorance. What he should say is that he doesn't know how to do it.

Steel is still our most common metal. Nearly 92% of the commercial metals produced in 1953 were steel and steel alloys. By far the major portion of this production was in the carbon steels, particularly the low-carbon grades. Alloy steels are growing in popularity, however, and their use has eased welding problems in many instances.

Instead of obtaining strength from a high-carbon steel, difficult to weld without cracking, a readily weldable alloy steel can be substituted. Even the high-carbon steels, however, are "difficult to weld" only by conventional mild-steel welding techniques. They can be welded if you want to take the trouble to find and apply the correct technique for the "over 0.45% C" steels. Usually, though, it is easier to resort to an alloy steel, and the results are generally more satisfactory.

COPPER alloys make up a large segment of the non-ferrous field. Copper will alloy freely with at least 30 of the hundred or so known chemical elements. Of these 30, 17 are used in making commercial copper alloys.

For welding purposes, the copper alloys fall into two broad classes: the brasses and the bronzes. If you alloy copper with zinc—in proportions of 1% up to 50% zinc—it's a brass. Some 15 different brasses are produced commercially.

If the alloying element isn't zinc, the copper-base alloy is termed a bronze. Copper-tin was the classical formula for bronze but silicon, aluminum and beryllium are also being used now.

Aluminum bronze possesses the useful property of being hardenable by heat treatment. As a result, high tensile strengths may be developed, and it can be hardened to serve like steel. Aluminum bronze is used for cold chisels and other tools that must be non-sparking to avoid starting fires in hazardous atmospheres. Another important use of aluminum bronze is for bearings. Though not the hardest alloy known, it does seem to provide the longest wearing bearings.

THE other principal non-ferrous metals are the light ones—aluminum and magnesium. These used to be "difficult to weld" too, and in particular by the fusion process, but the advent of the inert-gas shielded arc processes has changed all that. Using Mig welding, huge field tanks of aluminum and aluminum pipelines are being fabricated as well and as fast as steel ones. Aluminum tanks and pipelines are wonderful for resisting corrosion.

This jet age has resulted in an entirely new category of alloys—the so-called "superalloys." These are mostly non-ferrous, ranging from high-chrome alloys to complicated blendings of nickel, chromium, tungsten and cobalt. Here, again, welding has proved a boon to fabricators. It makes no difference how complicated the alloy or how high its melting point; it can be welded by some process.

Titanium is another metal of the jet age. Though its production is still extremely limited, facilities are being continually expanded. The 1953 production of 3,400 tons is expected to be at least quintupled by 1956. Even this may not be enough to keep pace with the demand for this desirable metal.

Titanium's advantages of high melting point and a tensile strength equivalent to that of steel at half of steel's weight are well known. Its tendency to oxidize is an undesirable quality. This can be sidestepped in fusion welding, however, by shielding the weld with an inert gas. And titanium is little more difficult to resistance weld than stainless steel.

Our new hard-facing manual has separate sections showing typical hard-surfacing applications in SEVEN basic industries. Every procedure job proved.

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Describes complete line of Victor alloys for gas or electric manual and automatic welding.

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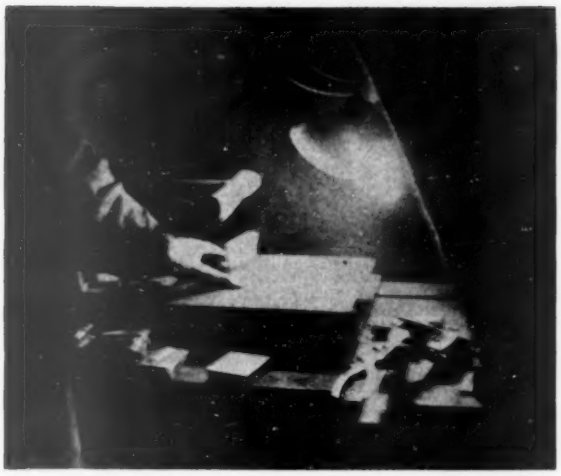
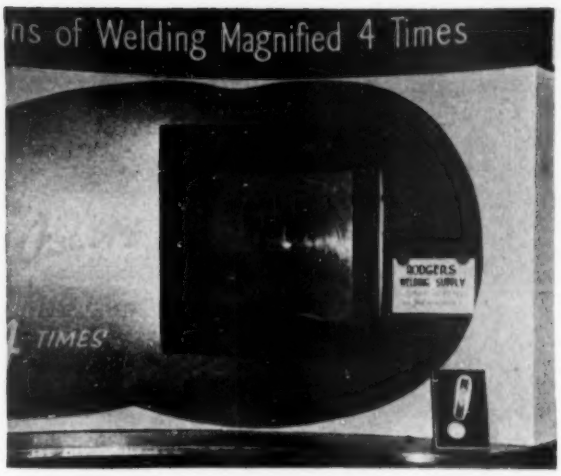




"WELD-O-SCOPE" projected a four-times-magnified welding arc (shown at left) onto a ground glass "television" screen

Live exhibits feature AWS week in Buffalo

Aisles were jammed, manufacturers ran out of literature and out of demonstration material. It was cold, it was blustering in Buffalo, but man what a welding show!

BY HERMAN C. PHELPS

FOR THIS writer's money, it was a joy to walk from one booth to another and see so many live exhibits of methods and products at the second all-welding welding show. Nearly half of the exhibitors had live demonstrations, ranging from simple arc welding behind a colored plastic booth to an elaborate affair that included five different types of metal fabrication. The show was staged at the Buffalo Memorial Auditorium, Wednesday May 5 through Friday May 7. Altogether, there were 99 exhibits.

At 8 o'clock one evening the aisles were so jammed that just to roam from booth to booth presented a problem. And the aisles were laid out wider than usual, giving ample room for a normal crowd. By closing time Friday evening, 7,683 visitors had been clocked through the entrance.

Slag-Gas Welding Method

One of the booths that attracted the biggest crowds featured a new automatic welding method in which the weld is shielded *both* by a thick blanket of slag and by a gas. The slag is produced by a flux-cored electrode that, believe it or not, can be wound on a reel like ordinary welding wire. The gas, not a product of the flux, is carbon dioxide.

Two different machines were demonstrated: one fully automatic and the other semiautomatic. The fully automatic machine welded rimmed steel ⅜ in. thick laid on a copper back-up plate. Welding was done at the rate of 47 ipm. Currents from 300 to 2,000 amp may be used with this machine.

The semiautomatic model has a boom as light in weight as a stick electrode holder and as easy to handle. Welding currents between 300 and 1,500 amp are used. Current may be either d-c reverse polarity or a-c.

Another booth demonstrated Mig welding of a colored television picture tube. The internal parts necessary were too small to install through the thin opening of the glass bulb. Hence it was decided to manufacture the bulb in two sections and weld the two glass sections together after the internal parts had been placed. However, the glass itself could not be sealed with heat without danger of affecting the sensitive parts inside. The difficulty was finally overcome by attaching stainless-steel flanges to the two glass sections and butt welding them together tightly in a special rotating fixture. While the crowd watched, they were arc welded by means of a high-speed automatic tungsten inert-gas welding machine.

Next year's spring technical session will be in Kansas City.

Arc "Televised"

Another booth "televised" a demonstration of welding electrodes. The operator worked in an enclosed booth. By focusing strong lights on the workpiece and then using a series of reflectors, a four-times-enlarged picture was thrown on a ground glass screen out front. It looked just like a television picture tube. This unusual method of projecting the welding arc was developed in the Alloy Rods Co. Research Laboratories. Its original purpose was to facilitate the study of arc characteristics.

FRED Plummer, AWS president, flame-cut the chain and officially opened the 1954 Buffalo Welding Show

NEW process uses flux-cored welding wire with a carbon dioxide shielding gas. It drew large crowds

An "envelope-size" air valve measuring 5 by 2½ by 2 in. and weighing only 2½ lb was shown at another booth. It is capable of operating at 800 or more cycles per minute. It is one of the smallest four-way two-position solenoid-operated units made by its manufacturer. It can be mounted directly on welders, small jigs, fixtures and similar equipment.

A few booths used the old type of carnival pitch man. One had a prospector from the hills with what appeared to be an authentic six weeks' growth of whiskers. Another clever interest catcher was a little chap by the name of Joe McGee, who was attired in a complete welding outfit and operated from a gal's knee. He had a wisecrack for everybody that walked by.

One manufacturer of silver-brazing alloys demonstrated a gas-fired heating unit that had boosted production many times in a particular application.

A new development in inert-gas shielded welding was an automatic process for welding electric motor stator packs. The torches, mounted on a continuously feeding machine, made simultaneous welds to join the segments of stator packs in a matter of seconds. These torch welds were made in an argon atmosphere.

More Automation

In line with today's trend toward automation, a pushbutton welding machine was demonstrated that consisted of a welding-head "manipulator," a set of turning rolls and a work positioner—all three mounted on a common base. The positioner had 19 separate movements, and the cycle could be repeated continuously without manual assistance. The boom on which the welding head was mounted traveled in or out at selected welding speeds and could also be moved up or down. The mast supporting the boom could be rotated a full 360 degrees, while the welding head itself could be swiveled at 180 degrees.

"American industry stands on the brink of a new production revolution, that of automation," prophesied Fred L. Plummer, president, American Welding Society, speaking at the society's annual dinner at the Hotel Statler, Buffalo, on May 4. "Welding will play a key role. Only welding can join metal parts in the continuous and high-speed processes which automation demands. Equipment is already in use in the automotive industry that can make 30,000 welds an hour, and the end is not in sight.

"We are not in a recession period," observed Mr. Plummer. "The contrary is the truth. We have but recently stepped down from a high ladder of war activity. Let us turn a deaf ear to those mongers of gloom who spread the insidious words, 'poor business,' 'recession' or 'retrenchment.'

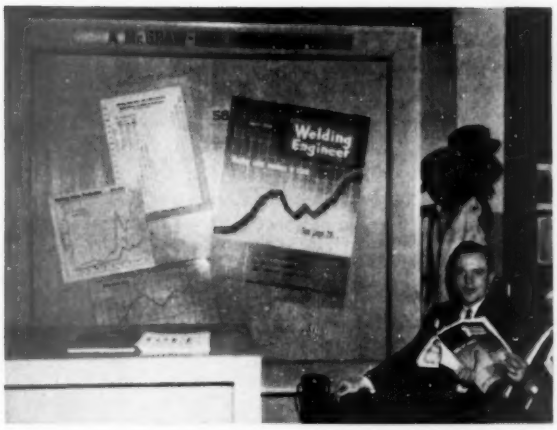
"The truth is that, today, we are enjoying the experience of having mounted the first step of an upgoing escalator; the first stage of a peacetime boom which may be far greater than any this land of ours has ever known.

"Whether you are fabricators, producers of finished consumer products, or manufacturers of welding machines and equipment, we suggest that you look back to 1925! Check the steel tonnage output, a reliable barometer for your output and sales that year. Check the number of automobiles produced in 1925; the volumes of coal, oil or electric power consumed by industry—additional reliable indices. Check the carloads of industrial products hauled by our national carriers—and international as well—all made by American manufacturers and sold to American and international users. Check the tonnage of mechanized farm equipment produced in 1925; the volume of welding machines, equipment, gases, supplies and welding rods or electrodes sold that year. Check the amount of dollars in savings institutions and in public investments in ratio to this country's population for 1925. And, finally, check the U. S. census figures and industrial and economic indices for that year—1925!

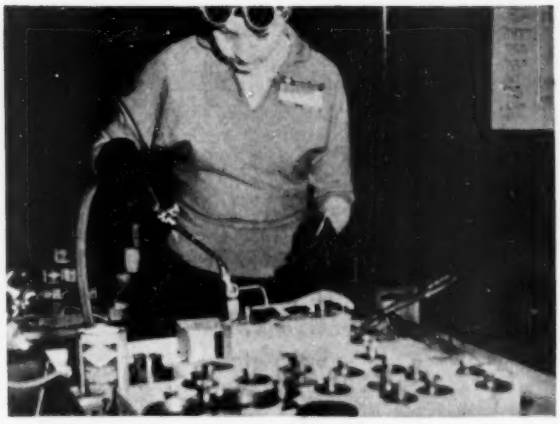
"Then check all of the same for today!

"But let us not use 1953, a year of artificial war inflation. Nor 1952 nor 1951! Let us hold to our 25-year cycle and check our volumes of 1950 against those of 1925. Each sales record will vary, but all will show that your volume during that quarter century increased many and, in many instances, many-many times.

"Just to meet the needs of our increasing population alone, we must produce millions of appliances, thousands of miles of additional highways, hundreds of new bridges, several million new homes, millions of tons of communications facilities, millions of radio and television sets, many hundred thousand tons of air condition-



BOOTH where the editors learned what kind of articles their readers want to see in WELDING ENGINEER



YOUNG lady never had a torch in her hand before the show. She did all right, too, in silver brazing

ing equipment, several hundred thousand motor trucks and rail freight cars, thousands of public office, hotel, entertainment, sport, school and community structures, a hundred thousand units of mechanized farm machines, thousands of miles of pipelines, several hundred thousand airplanes and millions of tons of armament products for protecting ourselves and the free world. To produce all this will require that we construct millions of square feet of new industrial plants! And all of this is only what we will need to provide for our increasing population!"

Those Technical Sessions

A total of 40 papers, presented at 14 sessions, were on the program of the American Welding Society's spring technical meeting. The meeting ran concurrently with the welding show but began a day earlier. Here are some of the highlights:

Eugene B. LaVelle, of General Electric Co., Hanford, Wash., injected some well placed (and spaced) humor. He unfolded a paper 8 ft long, which he told the audience was a typewritten list of questions about welding.

LaVelle also stated that the fabricator must analyze all factors of the process of adjustment for inert-gas-shielded arc welding. Thirty-eight different factors govern the practical use of the process. There are others, but these are the most important. The 38 can be divided into four general headings: (1) electrodes, (2) atmosphere, (3) electrical settings and (4) workpiece. A proper understanding of the nature of these many factors and how to control them is essential to any fabricator who uses the process.

"Spot-Gun" Welding

C. A. McClean, of Air Reduction Sales Co., New York City, talked on a "spot gun" for tungsten inert-gas spot welding. McClean stated that it provided the fabricator of thin-gage steels with a method of producing much the same type of joint as that obtained with resistance spot welding. It has the added advantage, though, of making welds without the need of a back-up to complete the circuit and without forging pressure. McClean said that the arc-spot process may also be used in large plants where the end product is too large to permit the use of a resistance welder that will reach both sides of the metal to be joined simultaneously. The gun is especially adaptable to the manufacturer of office furniture, aircraft parts, electrical appliance cabinets and automotive assemblies, he said.

Magnetic-Flux Welding

A welding process that depends on a granular ferromagnetic flux was described in the paper by Howard S. Avery, Turner C. Brashear, Jr., Henry J. Chapin and Gerald H. Edmunds —all of American Brake Shoe Co., metallurgical department, Mahwah, N. J. The flux is held on the electrode by the magnetic field resulting from the flow of the welding current through the electrode. Thus the electrode wire, which is fed continuously from a coil, reaches the arc with a flux covering.

Though this type of welding offers many advantages, it introduces other problems peculiar to the magnetic-flux. The magnetic permeability of the granules must be controlled; the granule size range and the distribution within this range are important, and the relation between orifice size, granule specification and flux type must be carefully worked out by research and accurately controlled in commercial production.

The flux must flow freely in the hopper and through the nozzle. As manufactured, the magnetic fluxes will do this, but they must be kept dry. Damp flux will not only flow poorly but is likely to cause porous deposits.

Horizontal and Vertical

Likewise indicative of the trend toward automatic welding was the paper by Amel R. Meyer, chief of welding research, Graver Tank & Mfg. Co., Inc., East Chicago, Ind. Mr. Meyer told about recently developed procedures for adapting the submerged-arc process to the welding of vertical and horizontal joints in field-erected structures such as large storage tanks.

The foremost requirement for submerged-arc welding of a horizontal joint is a stable flux bed. Newly developed flux-supporting devices are designed to maintain a stable flux bed at the welding site and to support the flux cover and the molten weld deposit throughout the solidification cycle.

For the submerged-arc welding of a vertical joint, a stable flux cover must be maintained in that position

LaVELLE: "A few questions that they have asked me about welding"

TALKING Joe McGee with Tommy Atkins. Joe knew all the answers

immediately adjacent to the welding zone. In addition, a positive upward and inward (toward the plate surface) pressure must be applied to the welding zone. The inward pressure holds the deposited metal in position until it solidifies.

As adapted to vertical welding, the submerged-arc process might be described as a "compressed-arc" method. A compressible glass fiber strip is flux-loaded as it is continuously carried toward the welding zone. As this strip is rolled onto the base plate over a pressure shoe or roller, the outer portions of the flux mound are urged inwardly and upwardly so that they press toward the arc zone. Final firm support of the deposited weld metal is effected by the partially compressed glass fiber strip, which acts through a very thin layer of fused and unfused flux.

A long, detailed review of welding processes with respect to their degree of mechanization or automation was presented by Warner H. Simon, welding engineer, Dresser Industries, Inc., Bradford, Pa. Processes covered by Dr. Simon in this scholarly study were: manual arc welding, automatic oxyacetylene welding (including hot pressure welding), cold pressure welding, atomic-hydrogen welding, inert-gas welding (including both tungsten and consumable electrodes), submerged-arc welding, spot welding, seam welding and flash welding. A wealth of information in this paper!

Mig welding of carbon steel was discussed in the paper given by J. R. Craig, Linde Air Products Co. Typical practical uses and process economics were presented realistically.

Spot Welding Thin Aluminum

I. W. Johnson, material and processes laboratory, large steam turbine generator department, General Electric Co., Schenectady, told how slope control is being used to spot weld thin sheets of aluminum alloys ranging in thickness from 0.016 to 0.040 in. Previously, such welding has been done with stored-energy machines. With the up-down slope control and electronic voltage regulator, however, standard single-phase a-c equipment can be utilized to meet the requirements of MIL-W-6860.

For the benefit of the uninitiated, the up-down slope control is a supplementary device used in conjunction with standard welder control panels. In addition to the gradual increase of the current, it also permits a gradual decrease of the current after the weld has been completed.

More information on the single-phase spot welding of aluminum alloys to MIL-W-6860 specification was given in the paper by Jean F. Harris, The Taylor-Winfield Corp., Warren, Ohio. The study described was undertaken to determine the quality and consistency of spot welds on heat-treatable aluminum alloys 24S and 61S. The paper presented the basic weld schedule data for four gages ranging from 0.020 to 0.091 in. thicknesses in 24ST Alclad, and 0.020 to 0.102 in. in 61ST4. The basic technique was to use a shaped wave form of up-slope and down-slope currents with forging pressure.

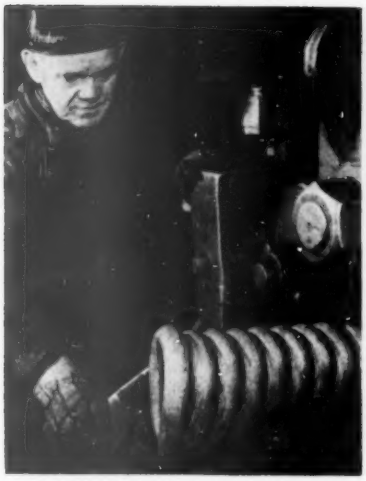
Another Taylor-Winfield engineer, Walter F. Haessly, discussed the practicality of using flash welding for joining copper to aluminum tubing on a production basis under circumstances where weld quality must fulfill the most stringent requirements. Weld schedules were given for two common material sizes. Pinch-off dies were used to strip off the external upset metal in one application.

An interpretation of "package type" standards for RWMA A-1 transformers was offered by J. F. Deffenbaugh, F. E. Murray and V. A. Rathfelder, all of The Federal Machine and Welder Co., Warren, O.

These transformers were developed specifically for joining subassemblies of relatively light gages of mild steel with a closely spaced series of spot welds. Since few of the various types available are interchangeable, either physically or electrically, it became increasingly apparent that there was a definite need for standardization of this type of transformer. The RWMA Type A-1 standards define the electrical and physical properties of this transformer within rather close limits. Most of the transformers of this type use oriented steel strip for the core.

Three different plant visits were arranged by the AWS entertainment committee. Wednesday visitors were taken on a tour through the Canadian Hydro Plant, Ontario, Canada. This plant started in 1950. It comprises 12 units and a pumping storage first stage of 1,428,000 hp capacity. When completed it will have a capacity of 1,370,000 kw, with 1,820,000 hp. Thursday visitors were shown the plant of the Bethlehem Steel Co. at Lackawanna, N. Y. It has 17,000 employees and produces 4,740,000 tons of steel annually.

The visit through the Ford Stamping plant at Buffalo drew the greatest number of visitors. Here members had an opportunity to see both manual and automatic welding procedures fitted into and serving the Ford production. The plant comprises an area of 101 acres, with one million square feet of plant floor space. Here Ford employs 4,350 employees, 300 of them weldors. Each day, 2,600 tons of steel are consumed in stamping out parts for Fords, Mercuries and Lincolns.



WROUGHT-IRON bars, 25 to 30 ft long, are wrapped around mandrel to form chain links 1½ inches thick

LINKS are heated in a furnace to 2,800 F. They are kept at temperature by forced draft from a fan

TAKEN from furnace, a link is slipped into the chain and closed on an anvil with a power hammer

HAND craftsmanship is still important to the success of the weld, just as in the old blacksmith shop

Takes a blacksmith to weld big chains

ROUND Chain Companies are nearing completion of 7,000 tons of buoy chain, ordered by the U. S. Navy Bureau of Ordnance for use in connection with antitorpedo and antisubmarine nets.

This big defense order was divided among four of the Round Chain Companies: The Cleveland Chain & Mfg. Co., Cleveland; Round Woodhouse Chain & Mfg. Co., Trenton, N. J.; Round Seattle Chain Corp., Seattle and Portland; and Round California Chain Co., South San Francisco.

200 CHAINS A WEEK

The chain is made of 1½-in. wrought-iron bars. Each link is 9 in. long and weighs 10 lb. It takes sixty of these huge links to form a chain 45 ft long, and the four companies have been averaging 200 completed chains every week.

Smaller sizes of welded chain are made on high-speed automatic or semiautomatic machines. Big chain like this, however, is still dependent on skilled craftsmanship, as it was in Colonial days. In fact, the basic method is said to date back as far as the time of King Solomon in 1,000 B. C.

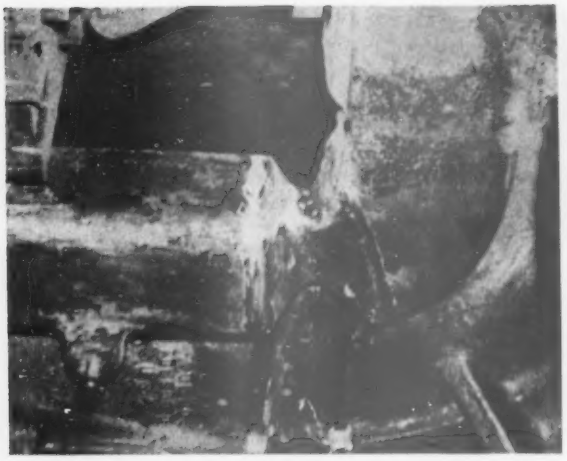
The four pictures give the main details of the production story. First, the raw material, a 1½-in. bar 25 to 30 ft long, is wrapped around a mandrel to form a series of coiled links. These are cut apart by a huge shear. Its special knives lop off the links one at a time and scarf them in the same operation.

FURNACE HEAT FOR FORGING

The links are next heated in a furnace to 2,800 F. They rest on a bed of coke and are kept at fiery heat by air from a centrifugal fan. When a link has reached the proper temperature, it is taken from the furnace and slipped into the end of the chain. The open end is then closed together by blows from a power hammer. It's the old-fashioned blacksmith method of forge welding—best suited of all to this particular application. In the third picture, the die on the anvil, called the nipple die, closes the weld on the inside of the link, while a second die, on the face of the hammer, closes the weld on the outside of link to proper size and radius.

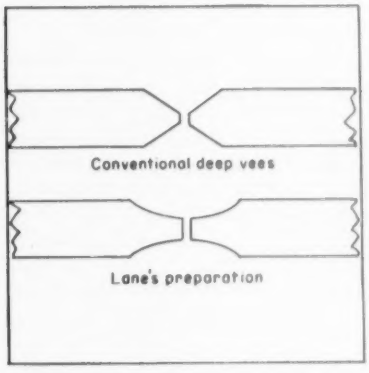
Although much of the work is done by the power hammer, hand craftsmanship still plays an important part, as the fourth picture shows. The weld must be as smooth and strong as the body of the link. Hand peening helps—just as it did in the good old days when the blacksmith was the only worker in red-hot iron. All chain from ⅞ in. up to the largest size (3 in.) is made in the same way.

After a length of buoy chain has been forged, it is put on a pallet and picked up by fork lift truck to be carried to the testing channel. This is 100 ft long, allowing two lengths of 45-ft chain to be tested at the same time. While one end of a chain is securely anchored to an iron post, tension is applied at the far end by means of a powerful hydraulic testing machine. Every length of chain is "pulled" to 60,340 lb.

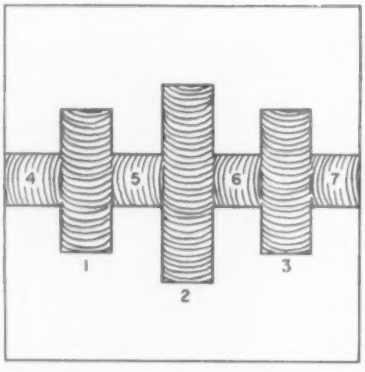


3—BROKEN punch-press frame illustrates how Lane prepares castings. Thick part of section is 8 inches

4—WELDED frame of the punch press dressed down to original size. The repair took 190 lb of bronze rod



1—INSTEAD of deep vees to prepare edges of a casting for a braze-welded repair, Lane favors a shallow "dished-out" treatment



2—LONG, straight stress lines are broken up by means of straps welded at right angles to the main seam. Slots are cut for the metal

Unorthodox methods of casting repair*

Most people believe, and the textbooks confirm it, that a fairly deep vee is correct preparation for cast iron. Mr. Lane disagrees. Growing even more radical, he insists that preheat is unnecessary in cast-iron braze-welding. And it looks to us like he's proved his case.

BY W. H. LANE

President, Midwest Casting Repair, New Castle, Ind.

MIDWEST Casting Repair, with headquarters in New Castle, Ind., specializes in the repair of cracked and broken cast iron. Our company endeavors to operate on 24-hour call to perform large repairs any place in the United States, Canada or Mexico. We have been specializing in this business of casting repairs for the past 12 years. From a modest start with two operators, we now employ 15 welding experts.

When we select a new man for training, we prefer a man without previous welding experience. Let me explain. We have found that a person with welding experience has formed certain habits that are hard to break. Our methods and technique in the braze welding of cast iron are much different from those in the textbooks. Therefore we take a man without experience so that we can train him our way without getting him confused by what he has learned in the past.

Our business has developed so that we are not called upon to perform any cast-iron repair jobs of a minor nature. The business has grown through word of mouth, repeat business and from welding shops that are not equipped or do not have the experience to perform complicated cast-iron braze-welding. Every job we do is on a contract basis, and our guarantee on the work is, in general, equivalent to the guarantee of the manufacturer of the original part. To put it another way, if a manufacturer guarantees a part for a year, we will

*Abstract of paper presented at the 1954 annual meeting of the International Acetylene Association, Chicago, April 7-9, 1954.

5—GRINDING edges to prepare bearing pedestal of steam engine

6—WELDOR first made a small tack weld to hold alignment. He then started welding in region at bottom of picture and continued toward tack

guarantee our repair job for the same period of time.

When we send a man out on a repair job, he takes with him a tool box that contains welding torch, cutting attachments, hose, regulators, welding rod and pneumatic tools. The last include chipping hammers, air grinders and air hose. We have found that oxy-arc rod works very efficiently in some weld preparation, and such rods are also included in the tool boxes.

Prior to the arrival of our man, the customer has little to do in the way of preparation. Our methods keep the dismantling of machinery to a minimum. If the job requires scaffolding or special housekeeping around the area where welding is to take place, the customer is expected to make these needed arrangements.

Before a torch is lighted, a great deal of consideration must be given to the overall job and especially to weld preparation. In my opinion, braze-welding of the type we perform is like building a house. If you do not have a good foundation, you certainly cannot have a successfully built house. If preparation and planning are bad, you will end up with broken castings.

Unorthodox Methods

When it comes to welding preparation, our operators do not always follow the textbook. For example, most people believe, and it is so written in many manuals, that a fairly deep vee is correct for cast-iron weld preparation. We have not found this to be so. The accompanying sketch (Fig. 1) shows what our technique is along this line.

It is also universal practice on cracks of certain types to begin welding at the end of the break and weld in the direction of where the break ends. We have not found it best to follow this practice. Instead we start out at the end of the crack and go out to the opening.

Our braze-welding methods in the matter of preheat are also unusual. We disagree with the belief that the nature of cast iron requires elaborate preheating. We have performed literally hundreds of successful braze-welding repairs on cast iron and have not used preheating, as it is ordinarily thought of. By eliminating preheating, it has been possible to avoid a great deal of dismantling. Costly preheating ovens are not needed, and there is no distortion that must be corrected by machining.

Several factors have helped us to eliminate preheating. First, we control stresses by proper welding procedure to attain as near-perfect a bond as possible. Our weldors are trained to spend the necessary amount of time on each square inch of weld so that there is no possibility of a small spot not being properly bonded. Any such small spot in which the bond was missed might well mean a secondary crack in the base metal.

Second, in braze-welding we feel that it is necessary to break up long, straight stress lines. We do this by means of straps at right angles to the main seam (Fig. 2). Slots are cut into the pieces prior to welding to prepare them for this treatment. In addition to producing an irregular stress line, these extra bronze straps serve to reinforce the narrower bronze deposit. Metal is first deposited in the straps, and then along the main seam, in the order shown by the numbers.

In every welding job, the bronze deposit is dressed by grinding down to the original surface. This means that there is no reinforcing bronze metal. In grinding off the excess, we remove a thin surface of bronze deposit, which we feel is brittle and is apt to cause trouble in the future. Because of our methods of breaking up long stress lines, our operators weld only short distances that can be easily handled.

Safety Counts First

Our safety precautions are carried out as would be done in welding in temporary locations in industrial plants. We may require an atmospheric gas test. Combustible materials must be removed. Fireproof screens to prevent sparks from reaching nearby locations are often required. Oil pools near jobs must be cleaned up, and fire extinguishers should be provided. Fire watchers are sometimes needed in hazardous locations.

Figure 3 shows a cast-iron punch press frame which has been cut out with an oxy-arc rod for braze welding. Notice that there has been a minimum of dismantling—even the dies are in the press. This photo well shows the dished-out weld preparation that is necessary for successful

7—GEAR of cotton compress had four broken teeth that were built up with bronze rod, 180 lb per tooth

8—HOPELESS? Looks like it, but this Diesel engine in Mexico was restored to service in 2½ months

cast-iron braze welding. The thickest part of the broken section is 8 in., and this tapers off to 5 in. at the back. The break is about 30 in. wide, and the repair required about 190 lb of bronze rod. Figure 4 shows the welded frame as dressed down to original size.

Three Times as Strong

I would like to explain our practices on the amount of deposited metal as compared to the size of part. The average strength of cast iron is not over 20,000 to 25,000 psi. The bronze, after it has been molten and been set, is around 60,000 psi. Obviously, the bronze has three times the strength of the cast iron. It follows logically that it is possible to braze weld cast iron by putting in bronze equal to about one-third of the section being repaired. Or if we weld up a piece of cast iron one-third of the way through, we have as much strength as originally provided.

This balance between deposited metal and the cast-iron section is based on a close-to-perfect bond between bronze and cast iron. It is also based on a purposely enlarged area of bond. Cast iron does not have much give—no ductility. We have found that if we put in too much weld metal, the part is likely to develop weaknesses at other points. So we just put back the original strength, and let it go at that.

180-lb Teeth

One of our interesting jobs (Fig. 7) was to rebuild four teeth out of nine that were broken on a half gear of a cotton compress. These teeth are about 5 in. in depth and 24 in. across. Each required 180 lb of bronze. The base metal was chipped and ground out below the level of the tooth in order to get a firm base on the rim. You will note from the picture that the rail has been cut out, and all these teeth have been tied together and brought into one unit. The rail is acting as a support for the teeth. The bronze deposit on the side of the rail illustrates the desired broken stress line earlier mentioned.

We have made many repairs to Diesel engines at oil-pumping stations. Braze welding on pumping equipment is usually a "fire-alarm" job, and every possible short-cut must be taken. The less dismantling the better, and this fits in very well with our methods.

Two illustrations on page 23 show repair of a bearing pedestal of a steam engine. In Fig. 5, you see an air-driven grinder being used to prepare the edges to be braze welded. Note how we get away from the usual vee. The next illustration (Fig. 6) shows the welding under way. First, the operator made a small tack weld just to keep the parts in alignments. After this, he started welding at the region at the bottom of the picture and continued toward his tack weld, knowing full well that it might pop loose as he proceeds. However, if it did pop loose, contraction would pull it back tight again by the time he reached the tack-welded area.

What you see here in Fig. 8 is not a train wreck. It is a 1,200-hp Diesel engine that had a broken crank shaft. This caused breaks in the cylinder, in the A-frame and in the crank shaft base. From the looks of the picture, it hardly justified repairs, but unfortunately replacement parts were not available.

Down Mexico Way

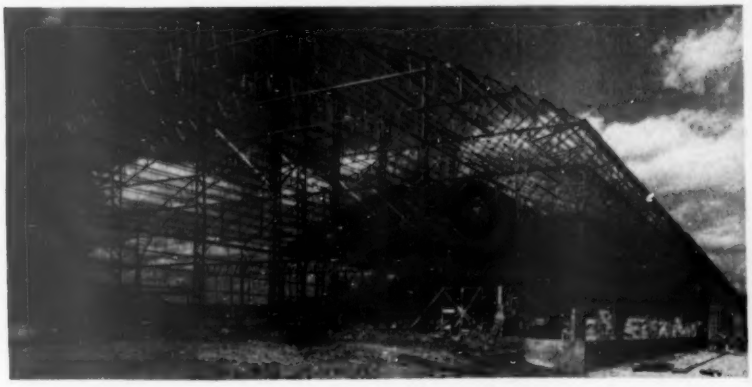
Our man had to travel clear to Mexico to repair this very necessary piece of machinery at location. The sections to be braze welded varied from 1 to 3 in. in section, and the job required 200 lineal feet of welding. Some new sections of steel plate were flame-fabricated, shaped with the torch and welded in. On this particular job, we used generated acetylene. It took 2½ months to complete the work, and approximately a ton of bronze rod was deposited.

This job was, in some respects, one of the toughest we ever tackled. It was necessary during the welding to line up the cross-slide on the A-frame to the other parts that had been broken. In order to make this alignment, the parts were set up and checked with a surveyor's instrument located some distance away from the welding site.

The mere problem of transportation of men and equipment into a remote section of Mexico to perform the work will be long remembered.

In conclusion, I can sincerely say that we have never yet been called back to repeat on a job because of failure. Many customers, including the larger oil companies, automatically call on us for repair jobs because they know that the cost of braze-welded repairs is going to be much lower than the cost of new equipment—to say nothing of machinery for which replacement parts are not available.

CORRUGATED siding and roofing were put on this new factory building while its welded framework was being erected



TRUSSES were shop fabricated and shipped to the site as half trusses

Up goes a factory!

BECAUSE a large factory building was wanted quickly, the Asbestone Corp., of New Orleans, turned to a welded steel structure for its new plant. The building is 500 ft long and 120 ft wide. It is covered with corrugated asbestos siding and roofing.

With the exception of H-beam columns along the outer walls, the entire structure was made up of lightweight steel shapes. The 120-ft span was broken only by a single row of lattice columns running through the center of the building. These 40-ft columns were built up of four 4-in. angles with 1-in. angles welded in diagonally to form the lattice structure. The 27 arch trusses likewise used angles for the chord members and diagonals.

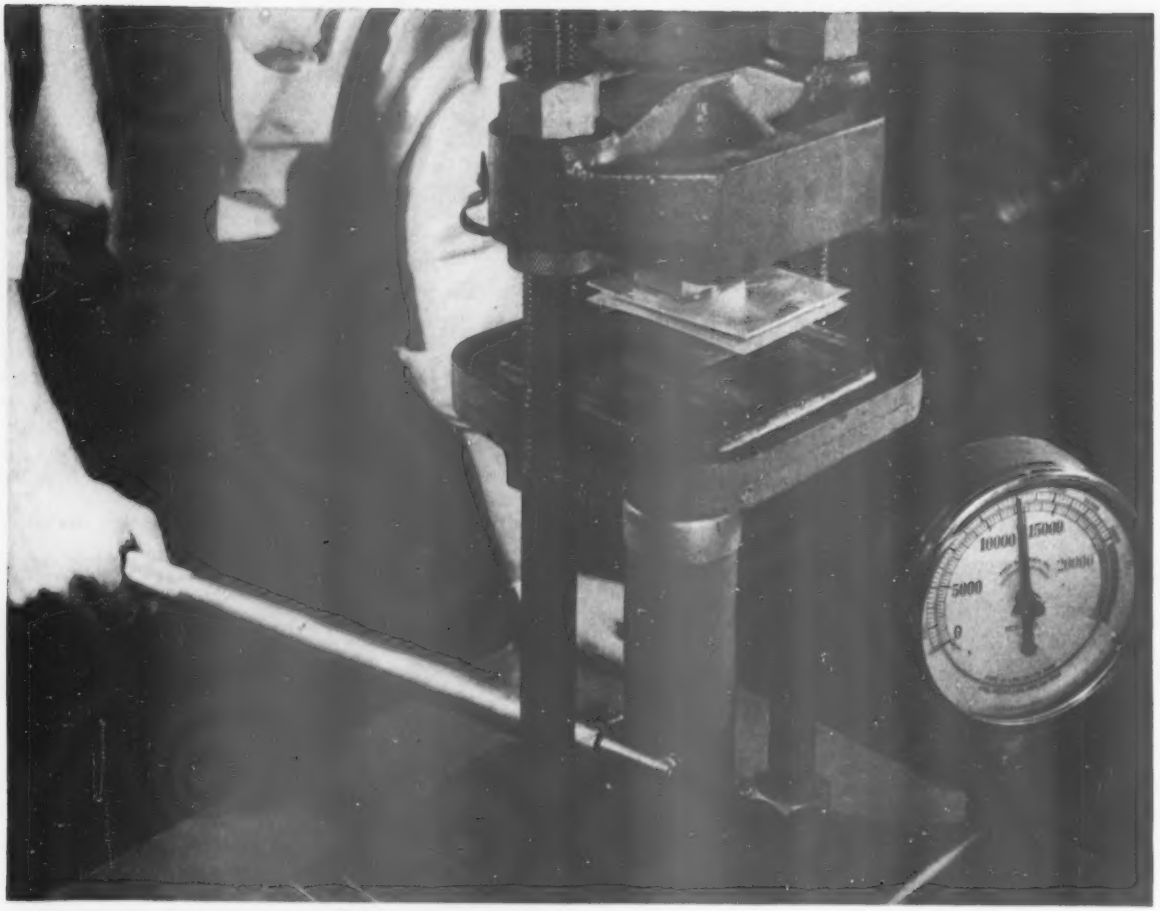
The columns and half trusses were shop fabricated and sent to the job for field erection. Field erection was entirely by welding. In some instances, the welding had to be done from 25 and 35 ft scaffolds or from precarious positions on the guy rods used for wind bracing. As fast as the columns were erected, the half trusses were welded into place and were tied together by sway bracing and 20-ft bar joists. The joists also served as purlins for supporting the corrugated asbestos roofing.

The type of construction made it possible to place much of the siding and roofing while the framework was under construction. As a result, one of the largest welded steel factory buildings in the South was ready for occupancy in record time.

Photos courtesy National Cylinder Gas Co.

SOMETIMES the welding was done from scaffolds or even worse . . .

FROM precarious perches on guy rods. Want this weldor's job?



APPLYING welding force by means of a 10-ton manually operated hydraulic press to join heavier aluminum sections

Pressure welding—how it's

Although there are at present very few industrial uses for pressure welding in this country, it has an excellent potential for sheet fabrication, electrical connections, joining of aluminum to other metals, etc.

IT HAS long been known that a bond can be achieved when two clean, smooth metal surfaces are brought into intimate contact. The theory is that when pressure is applied, the metallic surfaces are sealed off. Further pressure causes the metal to flow, exposing fresh metal. This pressure is sufficient to produce a weld, in the true sense, with a continuous grain structure.

Pressure sufficient to decrease the cross-sectional area by 50 to 75% is applied by means of a standard mechanical or hydraulic press or by roll-type dies. This produces a permanent bond. In general, the purer alloys in the soft temper are the easiest to weld by this method.

It will be apparent from the magnitudes of deformation involved that the softer metals, those that deform most readily, will give the most satisfactory pressure welds. Thus joint efficiencies are greatest for the non-heat-treatable alloys in the annealed condition.

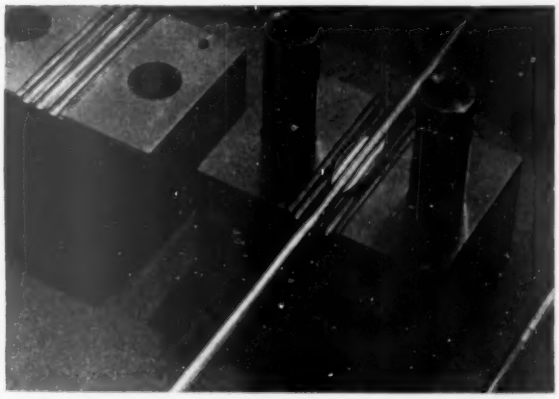
The pressure required to produce optimum reduction in cross-section varies with the gage, alloy and temper of the material. At room temperature, the range is from 50,000 to 200,000 psi. The pressure needed decreases as temperature is increased, but pressure welding is always accomplished at temperature below the melting point of any of the alloy constituents.

All the non-heat-treatable aluminum alloys can be pressure welded in any of the standard tempers. In the "O" temper, they have the best strength efficiency compared to the strength of the unwelded material.

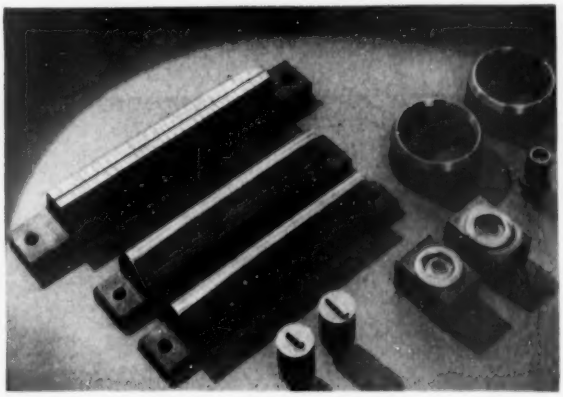
Although heat-treated alloys can be pressure welded also, greatest joint strength is obtained if the welding is done in the annealed temper and the parts are heat treated afterwards. The high-strength alloys give low joint efficiencies and may crack when pressure welded in the heat-treated tempers.

SIMPLE hand tool is suitable for making pressure welds in sheet aluminum up to 0.032 in. in thickness

ROLL welding on 0.051-in. sheet. Hand-operated rolls also shear off excess metal at right of weld



DIES for wire, with some as-welded and trimmed-off joints



TYPICAL dies. See text to find out what they're used for

done, where you can use it*

Chemical or solvent cleaning to remove oil or other foreign material is a necessary first step in preparing metal for welding. The preferred method for final cleaning that combines the necessary roughness with freedom from contamination is wire brushing by a rotary brush with stainless-steel wire bristles 0.006 in. to 0.008 in. in diameter. After brushing, there must be no contamination of the faying surfaces. However, if dust, dirt and moisture are excluded, a few hours—or even days—may elapse between cleaning and welding without adverse effects from re-formed oxide films.

At the present time, pressure welding is used for making lap welds in sheet and wire and butt welds in tube. Butt welds are also practicable in bar and wire stock. Not only can aluminum pieces be joined to each other, but aluminum can also be joined to other metals.

Copper-aluminum joints have been made successfully, but deformations of 50% or more are necessary to achieve optimum welds. Such joints in wire and bus bar have good electrical conductivity. Pressure-welded joints on wire terminals or connecting parts may become a field of application. Further investigation will determine whether industrial applications of joints between dissimilar metals are useful.

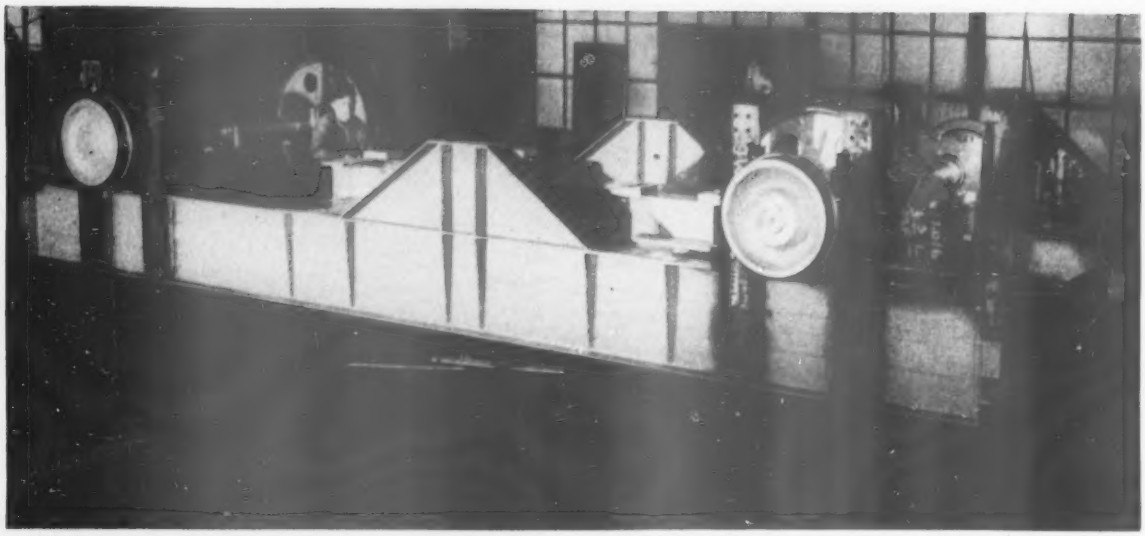
Tools have been developed to form sheet into tube, to wire brush the welding edges, to weld the edges between pressure rolls and to shear off the surplus metal—all in a continuous operation. Some of these are shown in the accompanying pictures. The picture at lower right shows a group of typical pressure-welding dies. In the center are two round-faced linear dies; at upper left is a shouldered die; at lower center are two types of small punches; and at right are several circular dies.

Possible fields of application of this technique include sheathing of electrical conductors, making of roof drainage leaders, television and radio aerial tubes, etc. In these and other similar articles, the performance of pressure-welded tube is adequate. Pressure welds can also be made for sealing metal packages, for floats of all kinds and for condenser leads, studs and handle connections. Very few of these fields have been explored.

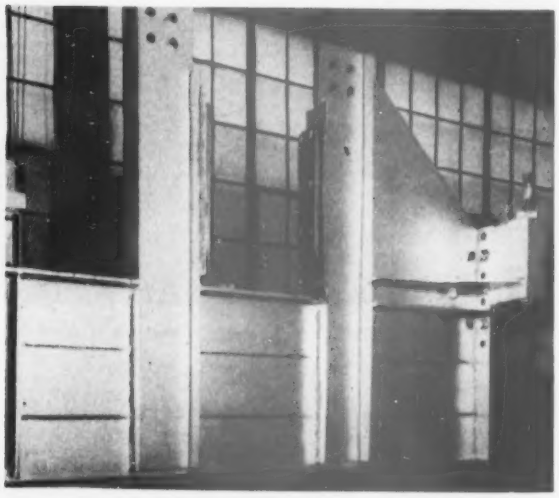
The strength of a pressure weld depends on the geometry of the section

(Continued on page 35)

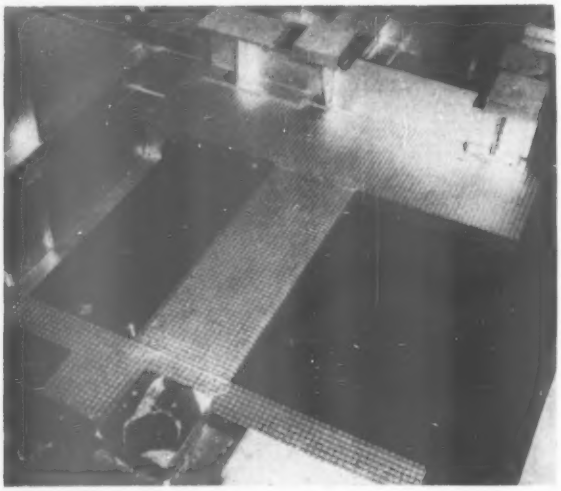
*From Chapter 10, *Welding Alcoa Aluminum*, a new book just published by Aluminum Co. of America, Pittsburgh.



MAIN trolley frame. Greatest weight saving was realized through the fabrication of welded deep-section girders



THREE-piece deep-section girders saved 2,300 pounds



WELDED supports (background) for motors and brakes

WELDED hoist drums eliminated casting pattern costs

WELDED housing allowed selection of proper bearing

COMPLETED. The welded trolley for the ore bridge holds 43 cu ft more than the old riveted trolley that it replaced

Three tons more payload

BY LEONARD NESGODA

Crane & Bridge Dept., Engineering Works Division, Dravo Corp., Pittsburgh

WELDING was one of the important factors in designing and constructing a new 8½-ton trolley on an ore bridge span. The original 5-ton trolley, designed and built by Dravo in 1929, had a riveted frame constructed from heavy I-beams, angles and plates, and the drums and bearing stands were steel castings. The new all-welded trolley frame weighs 36% less.

Dravo was given the problem of designing a trolley of larger capacity to run on an existing ore bridge. The problem resolved itself into decreasing the dead load of the new

	Old trolley	New trolley
Bucket capacity	80 cu ft	123 cu ft
Bucket weight	12,650 lb	14,750 lb
Bucket load (ore 140 lb per cu ft)	11,200 lb	17,250 lb
Weight of trolley frame	17,000 lb	10,800 lb
Weight of two hoist drums	3,620 lb	3,420 lb
Totals	44,470 lb	46,220 lb

Total weights are nearly equal BUT – 3 tons more payload!

trolley, which would thereby increase its lifting load. Here is what was done:

Payload capacity was increased 54%. The old bucket capacity was 80 cu ft; the new bucket holds 123 cu ft. Since the ore weighs 140 lb per cu ft, three more tons can be handled with each bucket bite. Yet the loads imposed on the bridge are no greater than those from the old trolley.

Lighter Weight Girders

From the main trolley girders a special 24⅜-in.-deep section was fabricated by flame-cutting 16-in., 45-lb wide-flange I-beams into two 8-in. T's and then welding the T's to an 8⅜-in. by 5/16-in. web plate. This gave a fabricated I-beam weighing 54 lb per foot. Comparing the main girders, the old trolley has 27 ft 6 in. of 90-lb I-beam, the new trolley 24 ft 5¼ in. of 54-lb welded beam. For two girders, the total weights are: 4,950 lb (old) and 2,650 lb (new).

Critical section of the main girders under the drum shaft was strengthened by welding a ½-in. by 20 11/16-in. web plate to the top flange. This plate is stiffened by welded plates along the sloping sides and top. The top plate was machined for mounting the drum shaft bearing stand.

At the critical section, the main girder has a depth of 45⅝ in. This deep a section was not necessary from a strength standpoint but was employed because a rather high pedestal was required for the drum shaft bearing stand. By welding the pedestal integral with the main girder, the deep section was placed where it is needed the most.

Cross members of the frame are WF beams and channels. Checkered floor plate ¼ in. thick closes in the frame except for the required rope opening. Motors and brakes were elevated about 12 in. above the top of the main girders by a built-up support made from WF beams, plates and thick pads under the motor feet and brakes.

After welding, the entire structure was machined as a unit, thereby assuring proper alignment between motors, brakes and drums.

A separate cradle support was used for each trolley travel drive unit. Motor and brake are mounted on a frame, called a cradle, which is pivoted around the axle. A restraining link prevents the cradle from rotating but permits slight vertical movement caused by deflections in spring mountings for the trolley axles. Here, again, a simple compact cradle frame was welded from 8-in., 31-lb WF beams and plates. Pads for motor brakes and bearing stands were machined after welding.

Most welds on cradles and main trolley frame were ¼ in. continuous fillets, but heavier welds were used on some of the larger sections. To secure motor and brake support beams to the cross beams on the main frame (covered by checkered floor plate), plug welds of 1-in. diameter were made. This causes tension loads directly into the flanges of the cross beams.

It is difficult to compare the cost of items made under today's shop environment and techniques with those fabricated 25 years ago. But weights can be compared. Since the trolley frame was reduced from 17,000 to 10,800 lb, it is obvious that 6,200 lb of steel were saved.

Some of the weight reduction in the new frame is because it is about 3 ft shorter than the old. The welded design, however, accounted for the largest percentage of weight reduction.

In addition to weight reduction, 15% fewer man-hours were spent in cutting, fit-tacking and welding the new frame than would have been necessary to cut, fit and rivet the old frame.

Welded Drums Save 47%

The old trolley design incorporated cast steel drums. The new drums are weldments. In spite of the increased line pull required on the new drums (6,150 lb old, 8,250 lb new), the two welded drums weighed 200 lb less than the two cast drums. Each drum shell was made from two rolled halves, welded longitudinally.

First, 1¼-in. plates having two edges machined to the drum length of 26⅛ in., were rolled to an inside diameter of 33⅝ in. The longitudinal seams were prepared for double-vee butt joints having 60° included angles. The inside vee, ⅜ in. deep, was manually welded, and the outside vee, ¾ in. deep, was a multiple-pass automatic weld. The drum ends, consisting of hubs, end plates and stiffeners were prefabricated. A single-bevel butt joint with a 45° included angle, ½ in. deep, joined each end to the shell.

Although the two drums are similar, they do vary slightly in hub sizes and positions; consequently, two patterns would have been necessary for castings. Furthermore, pattern costs would have had to be written off on this job because duplication of the drums would be unlikely. By resorting to welded drums instead of castings, the drums were obtained at lower cost and less weight. The total cost of the two welded drums including material and labor was 47% less than the cost of two cast drums.

Bearing Housing Also Saved

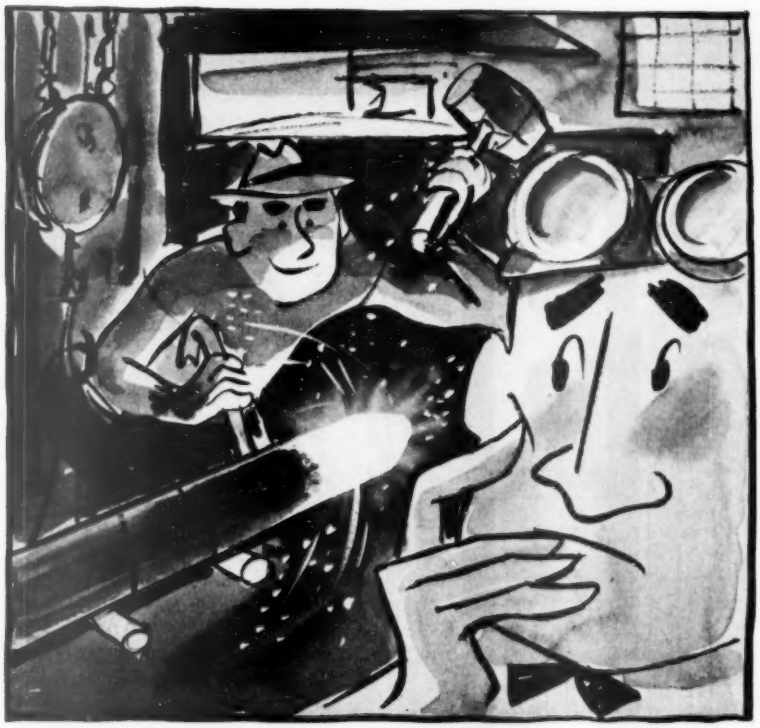
Another important use of welding on this trolley job was to construct solid steel housings for the antifriction bearings. These replaced the journal bushings in cast-split housings used on the old trolley. All-welded bearing stands have been standard practice with Dravo for many years. The flexibility in such a design permits the proper type and size of bearing to be selected for each specific application, after which the housing is made to suit the bearing. This is a more favorable situation than attempting to match a bearing to a cast stand for which a pattern is available.

A typical antifriction bearing housing is pictured on page 28. Construction is simple. The housing is simply flame-cut to shape from a mild-steel slab that is approximately an inch thicker than width of the bearing. This piece, generally, is about square except that the top corners are beveled for neater appearance. In this particular trolley bearing, the housing is 11 by 3½ by 11 in. The lugs or feet for bolting down are welded to the housing at each end. In this case, the lugs are bars 3 by 1½ by 7 in. A ⅜-in. fillet weld was made all around except for the bottom side, where a J-type joint was used to facilitate machining. Triangular stiffeners, ¾ in. thick, were then welded to tie the feet to the housing. After welding, the bearing stand was bored to the correct fit for the bearing OD, bottom machined and the bolting holes drilled.

The actual fabricated cost of two bearing stands was 47% less for welded design than the estimated cost of two comparable cast housings. This is comparing the two types of stands before final machining, which is assumed to be the same in both cases.

The old and new trolleys were not

(Continued on page 44)



KET'S eyes popped out when Pete began to hammer the face of that bit

Pete does his "bit"

When it comes to repairing a well driller's bit, welding—believe it or not—isn't always the best answer. It is sometimes important to know when *not* to weld—and why.

BY CLEMENT HOWARD

BUCK JONES, the local well driller, had left a big 250-lb, 6-in. drill bit at the welding shop in the "sticks" where our boy old Kettlehead was working.* The bit had a chip broken off its face, and Buck wanted the weldors to build it up with hardfacing rod. The boss gave the job to a guy named Pete to gas weld. Pete did it. The very next day Buck came with the bit but no sign of the hardfacing Pete had welded on. It had come off when the drill hit a rock.

After that little mishap, poor Pete was the victim of a continual barrage of insults and raspberries from Old Kettlehead. The part that came off had caused a lot of trouble to the drillers in getting it out of the hole. One of Ket's cronies was a member of the drilling crew and had kept Ket well informed when they met at the local pub (where they spent most of their pay checks bending elbows).

*"Ket wrecks a bike," WELDING ENGINEER, June, 1954.

HARD TO FACE

Ket figured Pete didn't know how to weld hardfacing metal on anything that big. Ket didn't know, or had forgotten, that adding a heavy layer of dissimilar metal is very often not satisfactory on a part subjected to continuous heavy impact. And a water well driller's bit has to take impact from the very first blow.

Poor Pete! Ket never let him forget that a boner had been pulled. Or let anyone else forget it. His foghorn voice informed everybody who came into the shop that Pete couldn't make a weld stick.

This play-by-play description went on for several days. Finally, the boss got soured on it, too. About the time the driller was due back in town, the boss told Ket to put some more hardfacing on this same bit. Ket made a great to do getting everything ready. He ground the bit neat and clean, gave himself a nice, neat taper and got all set. By this time, the local "yokels, wags and whittlers" from as far away as the fire house had heard about it, so they gathered around to see how it *should* be done.

Ket went at it like a real pro. Everybody had to admit he could swing a torch around like Marilyn Monroe walks. After he had the bit good and hot, he poured rod on real pretty like. Those beads of metal looked like the curves in a Ziegfeld chorus. Ket was real proud of himself. You could see he was going to be harder than ever to get along with now.

A few hours later the well driller came and took the bit. Ket was gloating like he'd won the Irish Sweepstakes. Two hours later the driller came back with the bit. None of that beautiful hardfacing was left. The bit, in fact, was in exactly the condition it had been before Ket took over. Chip and all.

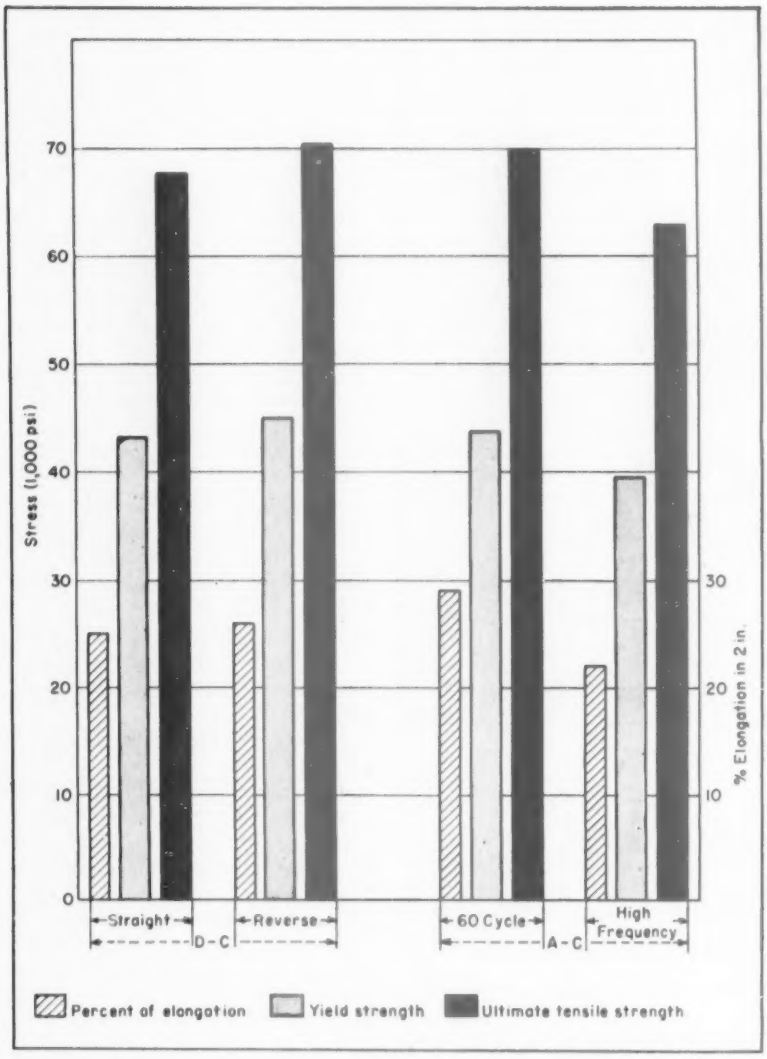
Ket's face was red all the way down to his neckline. Pete and the boss could hardly restrain themselves from gales of laughter. The "yokels" played it up for all it was worth. After about the umpteenth one of them had said, "Ket, I been a hearin' you ain't sech a hot weldor," our boy was ready to blow a fuse. He flatly refused to reweld the bit, and Pete finally figured it was about time to deal himself a hand.

A BIT OF DOING

First thing Pete did was to get a caliper from the driller and measure the OD of the bit. He found it a little undersize. Then, without saying a word, he built a good hot fire in the forge and buried the drilling end of the bit in the coals. After half an hour or so he lifted it out of the forge with the hoist and laid it down on the floor. Actually it was not on the floor but on some 3-in. pipes so it would be easy to handle.

About this time Ket's bump of curiosity was itching to beat the devil. Pete never explained a thing. Next thing he did was to grab a great big forging hammer and pound the face of the bit. Every once in a while he would measure the OD with the calipers, after which he went back to pounding and shaping the face again. This went on until he had

(Continued on page 35)



AVERAGE results compared for butt-welded specimens. Of the four ways of metal-arc welding, the high-frequency, alternating current showed the poorest properties of yield strength, ultimate tensile strength and elongation

Tested and found wanting

Claims have been made that the pulsations of alternating current agitate the molten pool and work out slag particles, thereby improving the soundness of welds. If this theory is correct, then a very high-frequency alternating current should produce an even greater improvement in weld soundness. But does it? Two young engineers, taking nobody's word for it, set out to find the answer.

BY WAYNE JACOBS AND CHARLES MARSCHALL*

THE object of our experiment was to compare quality of weld metal deposited by direct current against that deposited by alternating current. Four different ways of metal-arc welding were tested. These were d-c straight polarity, d-c reverse polarity, a-c 60-cycle and a-c high frequency (2,000,000 cycles a second). Two different electrodes were used on each method.

Welding Procedure

Sixteen pieces measuring approximately 6 by 14 in. were cut from a large section of ½-in. steel plate by means of a motor-driven oxyacetylene torch. The plate had the following composition:

Carbon	0.25%
Manganese	0.10%
Silicon	0.02%
Phosphorus	0.02%
Sulphur below	0.03%

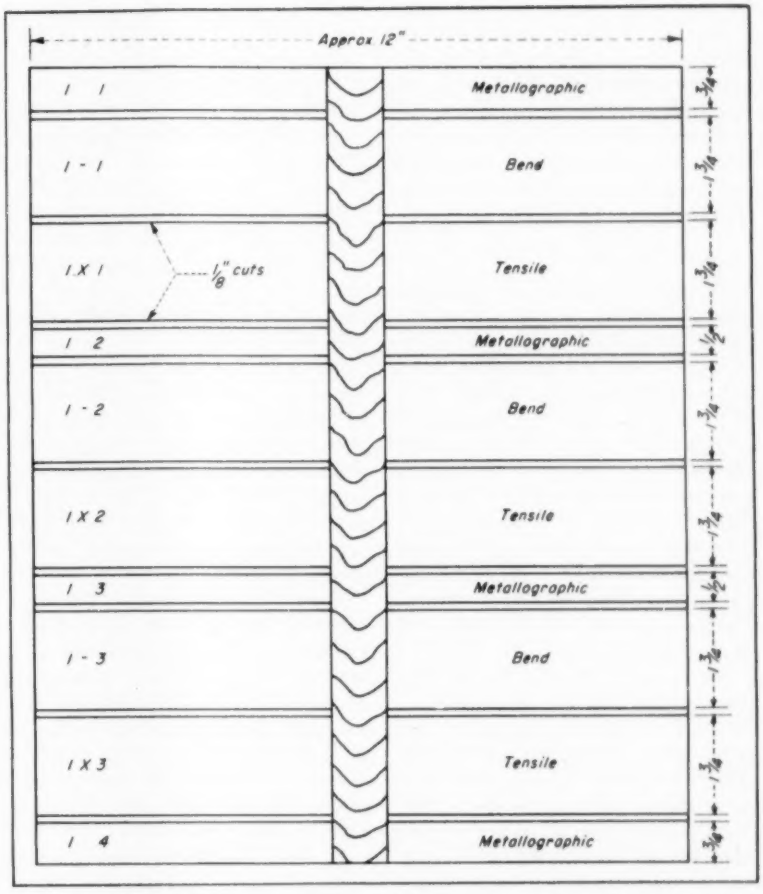
One edge of each piece was cut at a bevel of 60 degrees to form half the vee of the butt joint. The beveled surfaces were cleaned up with a grinding wheel to remove any oxides formed during cutting.

The plates were spaced approximately ¼ in. apart with a backing strip underlying the entire joint. The strip was low-carbon steel, about 1 in. wide and 3/16 in. thick, slightly longer than the plate. Welding currents were selected partly by recommendations of the company producing the two electrodes used and partly by trial passes on scrap pieces. All of the welding was done with 5/32-in. electrodes.

The first pass was laid straight to get complete penetration and all subsequent passes were laid by weaving. Great care was taken to insure complete removal of slag after each pass. The last pass was mostly reinforcement, which was machined off level with the plates before the test specimens were prepared. The backing strip was also machined off. Several of the welds showed incomplete penetration due to slag flowing between the plates and the backing strip. The welds showing this defect were given another pass, and the bead was ground off level with the plates.

*From a paper awarded second prize of $250 in the 1953 A. F. Davis Undergraduate Welding Awards. This paper by Messrs. Jacobs and Marschall was originally published in the *Wisconsin Engineer*.

Each plate was flame-cut into ten pieces: three for bend specimens, three for tensile specimens and four for examination macroscopically and microscopically. A three-symbol marking system was devised by which each specimen and its position in the plate could be readily identified. The first symbol (at left) designated the method of welding and the type of electrode; the second symbol the test purpose of the specimen, and the third symbol designated the position in the plate from which the specimen was taken. Thus if a specimen were marked 1X3, it would mean that it was a d-c straight-polarity weld made with electrode No. 1, a tensile specimen and taken from the number 3 position in the plate. For the first symbol, figures from 1 through 8 were employed to designate the four welding conditions with each of two electrodes.



EACH welded test plate was flame-cut into ten pieces: three for bend tests, three for tensile tests and four for metallographic examination. Symbols on the left identify the sample as follows:

Figure at extreme left indicates welding method and electrode type. Digits 1 to 8 are employed, the even numbers designating one electrode and odd numbers another. Thus numbers 1 and 2 both indicate d-c straight-polarity welding; 3 and 4 d-c reverse-polarity; 5 and 6 a-c 60-cycle; 7 and 8 a-c high-frequency.

Middle symbol indicates type of test according to code: X tensile specimen; — bend specimen; blank space a metallographic specimen.

Right digit refers to position of sample, as shown by the sketch.

Metallographic Examination

The four metallographic specimens were cut so as to leave only the weld and about one-half inch of the plate on each side of the weld. These small specimens were ground flat on an emery wheel and sanded smooth on a belt sander. They were etched with hydrochloric acid at 150 F for one hour and coated with a transparent lacquer. Specimens from each plate were then rated on a comparative basis with regard to porosity and overall appearance of the welds.

The same surfaces observed macroscopically were prepared for microscopic examination by a 2% Nital etch. Photomicrographs were made of representative structures.

The metallographic specimens were also used for hardness testing. Hardness readings were taken at the center of the weld below the last pass in the grain-refined area halfway between the plates, and at the weld metal-base plate junction at a spot horizontal to the center reading. All readings were taken on the Rockwell A scale and were converted to Brinell hardness numbers.

The bend test was not conducted according to standard specifications as we felt the extra work involved in preparing the specimens to meet specifications would not be justified. Accordingly, the bend tests were made on the ½-in. plate used in the experiment instead of the ⅜-in. plate called for by the standard specimens. Since this was a more severe test than the standard test, we felt that no significance would be lost.

The testing was done in a guided bend jig. A hydraulically powered 1½-in. cylinder of hardened steel bore directly on the weld. The maximum angle of bend was measured and recorded.

Tensile test specimens were prepared with at least two inches between shoulders including the weld. The width of the machined section was approximately 1 in. and the thickness approximately ½ in. This test was made to determine the strength of the joint rather than the strength of the weld material. The cross-sectional area of each weld was determined prior to testing with a micrometer, and punch marks were placed 2 in. apart on one side of the plate. Loading was done hydraulically. Loads at the yield point and ultimate strength were recorded as was the percentage of elongation in 2 in. The yield point was determined by the 0.2% elongation method.

For all weld-metal specimens, low-carbon steel pipe having an inner diameter of approximately 1¼ in. and a wall thickness of approximately 3/16 in. was cut into eight pieces of 10-in. length. These sections were then cut in halves along the length of

the pipe with a guided oxyacetylene torch. The resulting halves were laid on edge and pounded with a hammer until the inner diameter was reduced to about ¾ in. These sections of pipe were then filled with weld material, from which tensile specimens and specific gravity specimens were machined.

Test Results

The bend tests showed a definite lack of ductility on the part of the a-c high-frequency welds. Only four of the 24 bend test specimens failed to bend 180 degrees successfully. Two of these broke, one after bending 90 degrees and one after bending 135 degrees. Two others bent 180 degrees but had visible cracks. The two that failed were both a-c high-frequency welds and one of those that showed cracking was also a weld made by this process. Thus three out of four failures occurred in welds made with the a-c high-frequency arc.

The results of the plate tensile tests also bear out the lack of ductility on the part of the a-c high-frequency welds. From this test, the a-c 60-cycle welds appeared to have the best ductility, while the d-c welds, both straight and reverse polarity, gave intermediate values. However, only the a-c high-frequency weld specimens broke consistently in the welds.

In tensile tests of pure weld-metal specimens, the d-c reverse polarity welds showed the best ductility, and the a-c 60-cycle welds gave the lowest values. The d-c straight polarity welds and the a-c high-frequency welds were intermediate between these two extremes and approximately equal. The value for percent of elongation was better for the d-c straight-polarity welds, while the a-c high-frequency welds gave a larger percentage of reduction of area.

These results are intimately related to the type of fracture. Those which broke with a cup-cone type of fracture gave much better reduction of area values than those in which the failure was of the shear type. The d-c straight-polarity weldments seemed to fracture in an odd manner. For the weldments made by the other methods, the general rule seemed to be that if the failure was not initiated by a slag pocket, a cup-cone type of break would result. The d-c straight-polarity specimens, however, failed in shear even though no slag pockets were visible. This behavior accounted for the relatively good values for elongation but relatively poor reduction of area values exhibited by the d-c straight-polarity all-weld specimens.

To sum up, the a-c high-frequency welds exhibited a general lack of ductility, particularly in the butt welds. The a-c 60 cycle welds in some cases showed extremely good ductility, and in other cases very poor. The tendency, as revealed by the macroetching test, is for this type of weld to contain rather large discontinuities and inclusions.

The d-c reverse-polarity welds showed consistently good ductility; in fact the best of any of the four welding processes. The d-c straight-polarity welds had adequate ductility except for the relatively poor reduction of area values caused by the failure in shear of weld-metal tensile specimens.

The only notable results from the hardness tests was that the a-c high-frequency welds were definitely softer. The average hardness was about 49 Rockwell A for the welds made by the other three methods. On the welds made by a-c high-frequency welding, however, the center showed a hardness of 40 and the weld-base metal junction 44.

In the plate tensile tests the a-c high-frequency welds showed noticeably lower strength values for both the yield strength and ultimate strength. Welding done by the d-c reverse-polarity process gave both the highest strength and ultimate strength. The d-c straight-polarity and a-c 60-cycle welds gave intermediate values that were approximately equal.

Tests made on all-weld-metal specimens showed the d-c straight-polarity welds to have the highest tensile strength, while the a-c high-frequency welds were the weakest. The d-c reverse-polarity welds and the a-c 60-cycle welds gave values that fell in between these two extremes. The d-c reverse polarity welds gave higher values for ultimate strength, but the a-c 60-cycle welds had a higher yield strength.

The macroetched specimens showed a general lack of quality in the a-c welds, as was evidenced by the unevenness of the attack by the etching reagent. The a-c 60-cycle welds showed large discontinuities and inclusions. The a-c high-frequency welds also showed a lack of soundness but of a different type. Instead of large discontinuities, a generally unsound appearance was found over large sections of the weldment. The d-c welds, both straight and reverse polarity, were generally sound.

With regard to microscopic examination, the weldments were uniformly composed of very fine grains. They contained the same amount of pearlite, and there was no significant metallographic difference between them.

A specific gravity test seemed to confirm the lack of soundness on the part of the a-c welds. The values for both a-c processes were lower than for d-c welds. The d-c straight-polarity welds had the highest specific gravity and (hence density), while the d-c reverse-polarity welds were slightly lower in specific gravity.

Effect of Electrodes

With one exception, the mechanical properties of specimens were almost identical for the two electrodes used. This exception was the ductility of the all-weld specimens. One electrode gave considerably higher values for both the percentage of elongation and percentage of reduction of area.

With regard to the soundness of the welds, the two electrodes gave almost identical results in the specific-gravity measurements. The specific gravity of welds made with electrode No. 2 was 7.830; that for welds made with No. 1 was 7.810.

The fact that the results for the plate tensile tests and those for the tests made with all-weld specimens do not agree exactly indicates that the base plate does exert an effect. However, the extent to which the base plates can influence the results is not known. Any effect exerted by the base plate would be an effect that would be exerted on practical welded joints. Consequently, this effect has a rightful place in any evaluation of the strength of welded joints.

The influence of the electrode coating is also unknown. The electrodes used for the a-c high-frequency welds were regular a-c rods, not specifically designed for high frequency. This may have been a factor in the poor quality of the welds made by this process. In the other three methods, electrodes were used for the purpose for which they were designed.

One uncontrollable variable in welding experiments is the skill of the weldor. In this investigation, the same person did all the welding in order to eliminate the human element as much

as possible. The facts that the results were quite consistent and that the welds consistently exceeded the strength predicted for the electrodes indicate that the welds were quite representative.

Conclusions, Recommendations

The a-c high-frequency welds were generally softer, of lower strength and exhibited poorer ductility than welds made by the other three welding processes. The a-c 60-cycle welds seemed to have a tendency to contain discontinuities and inclusions of considerable individual size. The high frequency welds appeared to have a large amount of microporosity. The specific gravity of the a-c welds appeared to be lower, probably due to either macroporosity or microporosity.

Metallographically, the welds made by the different methods and electrodes cannot be distinguished from one another.

In most cases, the butt welds made by d-c straight polarity, d-c reverse polarity and d-c 60-cycle were stronger than the base plate. Since the rated strength level for the electrodes was an ultimate strength of 60,000 psi, welds can be made by any process to equal this rated strength.

The base plate appeared to have an effect. Just what this effect is is not known, however. Any effect the electrode coating may have had is also unknown.

The human element was not completely eliminated, and all results must be considered in the light of possible differences in the skill of the weldor for different processes or rods.

This investigation was conducted with a definitely limited number of samples. Our major recommendation, therefore, is that more extensive tests should be conducted.

Since the butt-welded joints consistently broke outside of the weld, it would be desirable to have a base plate strong enough to cause the joint to fail in the weld. This could perhaps be done by using as a base plate a higher phosphorus steel, which has greater strength but no greater hardenability than ordinary carbon steel.

Thank you, Mr. Jacobs and Mr. Marschall, for a detailed account of an interesting experiment. We are wondering though, what the tests would have shown had you used an electrode developed for high-frequency.

PRESSURE WELDING

(Continued from page 27)

at the joint after the welding deformation has been applied. If the joint is made on tools that deform the metal by reducing the cross-section, a weakened joint will result. If, on the other hand, the deformation is applied by upsetting the metal, then the joint area is stiffened.

The simplest example of the first type is a lap joint in sheet, made with a tool that reduces the cross-section about 70%. Some cold work is introduced in making the weld. This increases yield strength locally at the joint. The decrease in cross-section more than offsets this strengthening, however. Starting with material in the annealed temper, the tensile breaking load across the joint is limited to about 80% of the value in unwelded metal. Bending loads concentrate deflection in the reduced section at the joint, and the sharp groove presents a stress raiser that can affect the fatigue strength adversely. The use of such welds, then, depends on locating the joint normal to any bending loads and in areas where the loading is low. Local stiffening of the parts by using cross members may be a useful expedient.

Upset pressure welds are exemplified by butt welds in wires. The ends of the wires are upset about 80% of the diameter, so that a considerable increase in cross-section is obtained. The breaking load in this case is equal to the strength of the unwelded wire for any temper that has sufficient ductility to stand the deformation without cracking. This is true for all the annealed tempers and is also true when the upset portion has been trimmed off to the diameter of the original wire. The performance of such welds in accelerated fatigue tests—for example, running over guides and pulleys—has been very good.

Pressure welds do a good job of holding liquid or gas pressures. While test vessels have been made in which the joints resisted leaking at pressures over 100 psi, applications in this field will probably be for parts that must resist much lower pressures. Packages and cans, sheathing of cable to prevent moisture penetration, floats for gasoline or water etc., present likely fields for development.

Resistance to corrosion of pressure welds is as good as the parent metal. Since no fluxes, dissimilar metals or metallurgical changes from excessive welding heat are involved, the corrosion problem is reduced to determining the suitability of the parent alloy for the service intended.

PETE DOES HIS "BIT"

(Continued from page 31)

mushroomed the bit back to size for a space of 6 in. or more.

Finally, Pete had the bit faced up fairly smooth and the calipers slid over it nice and easy. Then he threw it back into the forge and turned up the bellows good. A short time later, he pulled it out and dipped the heated end into a can of powdered compound for a few seconds. He let this stuff bubble and soak in good. When the bubbling stopped, the bit went back to the forge again, and Pete repeated the whole process.

What's Going on?

Watching all this, Ket was about ready for a "couch" as a psychiatrist might say. After the second dipping, Pete stuck the bit into the quenching barrel and cooled it off quick. Then he hollered to the driller, "Take her away!" Not a bit of welding had gone on the bit. Several others were scratching their heads besides Ket, but Pete never said a word.

After three days had gone by, without word from the driller, Ket couldn't stand the suspense any longer. He went to the phone and called the driller at his place of business.

"How's the bit doing?" Ket asked.

The driller snapped, "I'll be right over" and hung up.

By this time Ket was so nervous he couldn't even hold his stinger steady. His welding began to look like pigeon droppings around the court house square. Finally the driller drove up; he ignored Ket (who had rushed up to meet him), walked over to Pete and shook his hand.

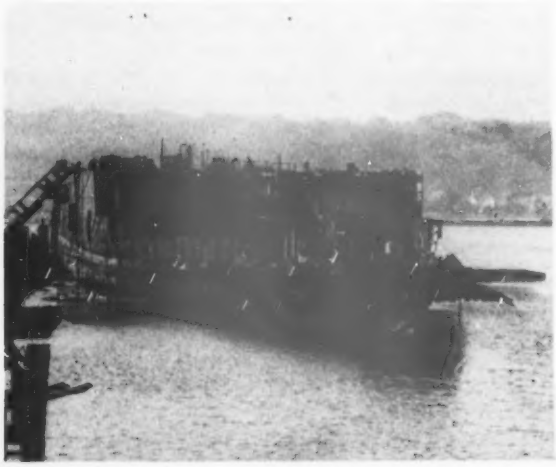
"Pete, I don't know what you did to that bit . . . but the dang thing is still in the hole. It's drilled deeper, faster and lasted longer than any bit we've ever used!"

Ket stood there scratching his ear and muttering to himself. "You're so stupid," Pete said, "you probably think 'falsies' are store-bought teeth."

1—SOUTHERN CROSS, in her heyday the pride of the Southern Seas, looked like this at the start of flame-cutting

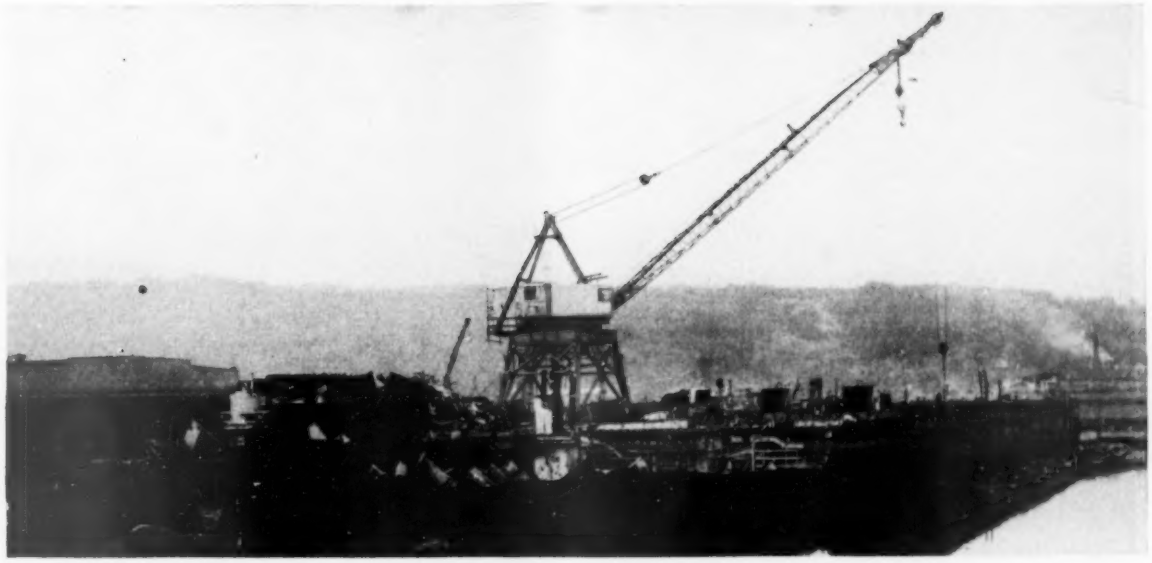
2—THIRTY days later. Superstructure is going fast

3—FOUR months and in greatly reduced circumstances



4—LOSS of metal causes her waterline to rise high

Going, going...



5—CLOSE to five months and getting down to the waterline. Hundreds of tons of steel have been slashed away

FROM luxury liner to workhorse to scrap! That's the saga of the *Southern Cross.*

Thirty-five years ago, this proud luxury liner slid down the ways at the New York Shipbuilding Co. yard at Camden, N. J. She was operated by the Munson Line to carry wealthy tourists on pleasure cruises of the South Pacific. The workhorse years were spent as a troopship when she was drafted by the U. S. government and operated by the Army as the Transport *Warton.* Though her life was not so glamorous, she was useful to the war effort.

Her long career ended at last, the *Southern Cross* was finally consigned to the scrap pile as being unprofitable to operate. The job of cutting her up was done in Seattle by the Learner Co., of Oakland, Calif. To carve up the 13,798-ton liner took five months' time as well as 1,289,000 cu ft of oxygen and 311,500 cu ft of acetylene.

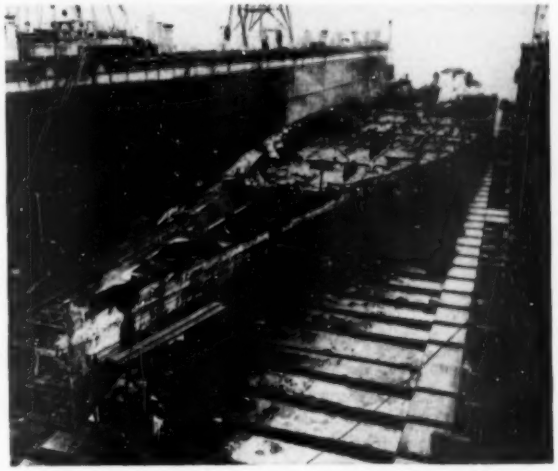
The cutting was done by manual oxyacetylene torches. When the work was at its peak, there were 25 flame-cutting operators aboard ship. They reduced the *Southern Cross* from a vessel 530 ft long to 9,000 tons of scrap for remelt at the steel mills.

While this is not an unusual story, it is nevertheless noteworthy because it typifies the efficiency with which ships of this size can be dismantled. The magnitude of the job rendered it mandatory to plan and lay out a special piping system in advance of the actual cutting operations.

To supply the large amounts of oxygen and acetylene needed, a bulk distribution system was set up. This comprised a special oxygen trailer and a 20-cylinder acetylene manifold. The two gases were piped down the bull rail where outlets led to the ship by way of hoses and special headers installed aboard ship. Each acetylene header was protected by an individual water seal. This system provided flexibility and other advantages.

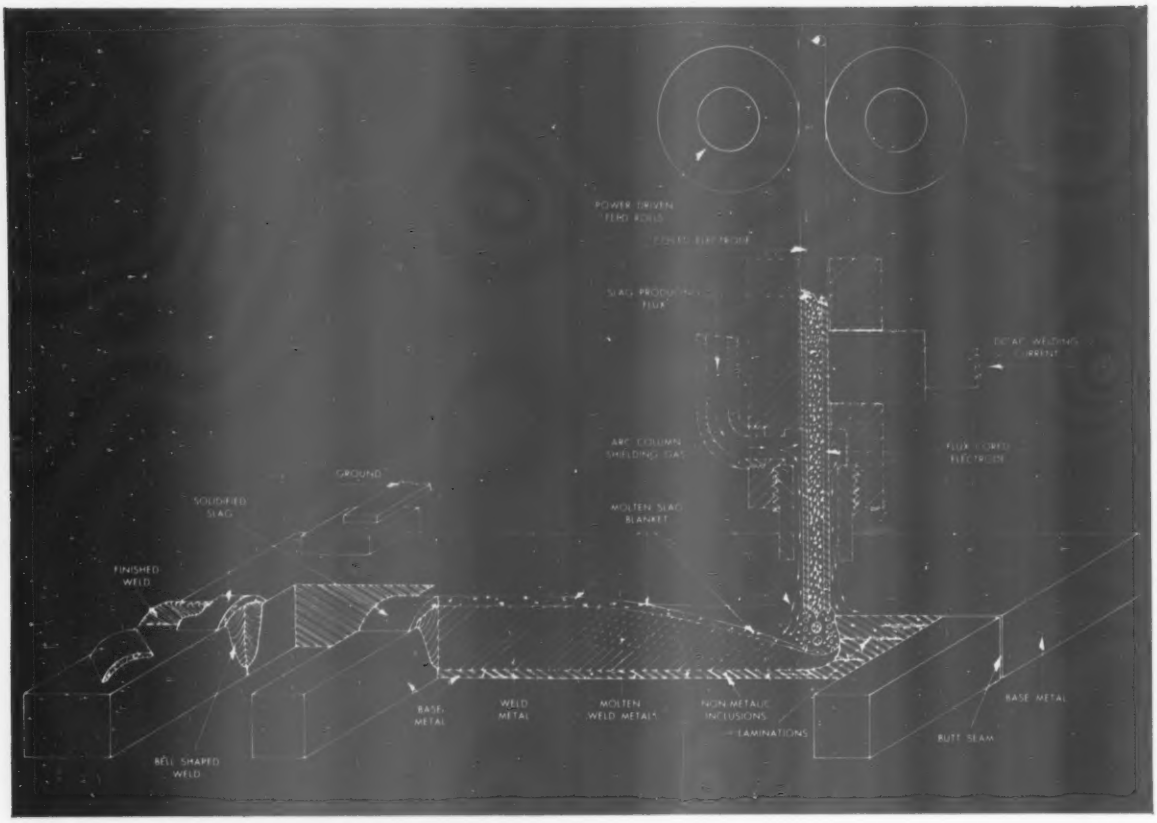
The pictures show the scrapping job from the time the operations were first started until what was left of the ship (practically nothing but her bilges) was towed into the drydock for the final scrapping.

Photos courtesy Air Reduction Sales Co.



6—IN drydock and ready for final stage of scrapping

Gone!



SCHEMATIC of slag-gas-shielded process, a totall new method of arc welding. Shielding gas is carbon dioxide

Here's the dope on slag-

Its developer—Bernard Welding Equipment Co., of Chicago—claims new efficiencies and economies are realized with the new process.

BY FELIX TANCULA

A 35-YEAR ambition was realized at the recent welding show in Buffalo when Art Bernard introduced to the industry his firm's "BERNARD-ARC" slag-gas shielded welding process. Applicable either automatically or semiautomatically, the slag-gas shielded process makes use of both a flux and a shielding gas. The flux, however, is incorporated with the electrode, presently as a core, not as a coating.

FASTER SPEEDS CLAIMED

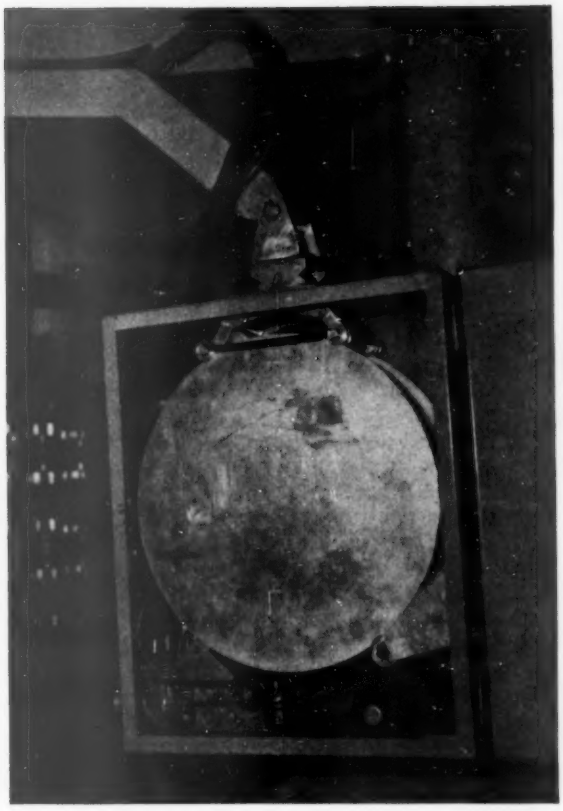
Bernard has claimed his electrode can be converted by the new process into weld metal at a rate of 10 to 40 lb per hour as compared with 2 to 8 lb per hour deposited by conventional flux-coated methods. The slag-gas shielded process is a manually applied method using continuously coiled lengths of electrode for uninterrupted welding.

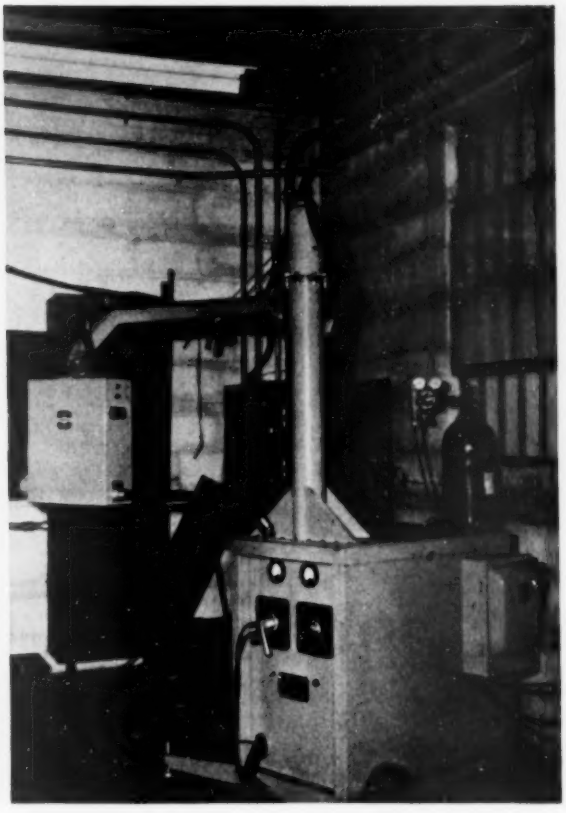
The new electrode, tubular in construction, has the flux contained within the cavity of the tube. The flux core melts and is transferred through the arc to become the refining and shielding blanket of slag. The gas, which is separate from and not part of the flux, is used to shield the arc column. The equipment which achieves this is as new as the process itself. The apparatus includes an arc "torch" that has welding current, shielding gas, cooling water and electrode all passing through the handle. The coiled electrode is contained within a cabinet that is attached directly to the welding head, which is supported by a free-floating boom. Weight of the torch in the operator's hand is no more than a few ounces.

With this design, the torch is easily maneuvered, and flexibility of the electrode has no bearing on the operation since the coil is not remotely situated from the torch. This feature permits use of larger-diameter electrodes.

The semiautomatic equipment has a box 18-in. square and 6 in. deep on a pivot arm; the torch extends 30 in. beyond the box. The torch can be worked in an area 12 by 24 ft without moving the constant-voltage welding machine. Elevation from floor level to 8 ft is possible, and the equipment is completely movable to any area in the shop. All-position welding is possible. The welder can be used on a-c or d-c.

Although applicable automatically, the process was devised with the thought of its use as a semiautomatic method because, as Mr. Bernard puts





FLOATING boom supports the feeding mechanism and coil of electrode wire. Operator has to hold only the "torch"

gas-shielded arc welding

it, "Industry was not so much in need of a more efficient automatic process as it was in need of a manually applied method . . . our aim was to come up with something that would offer new economy and new efficiency . . . a need recognized by manufacturers of welding equipment for a good many years.

"Industry knew there was a more economical method than the flux-coated electrode process, and it has been searching for it for a good many years. We were just a small company in a race to find this answer . . . but we feel that we have found it . . . this is not an improved method but an entirely new process.

Too Much Asked of Flux

"The flux-cored electrode is as old as the industry itself," he commented. "Many patents on such types have been granted. However, none proved commercially practical. They failed because attempts were made to include in the flux a substance that produced not only a slag for shielding the weld metal but also a substance which would emit a gas for shielding the arc column. It is impossible to shield electrode metal in droplet and ionized form as it transfers through the arc if the shielding gas is inside and not at the outside of the transferred electrode metal and flux."

In much of the research on a new process for welding common steel, Mr. Bernard had been working with gas. "Shielding the arc column is only one of about 37 functions of a flux. . . . We changed the direction of our search because we were then aware that we were asking too much of a gas, which couldn't be expected to do what the complex chemistry of a flux was doing."

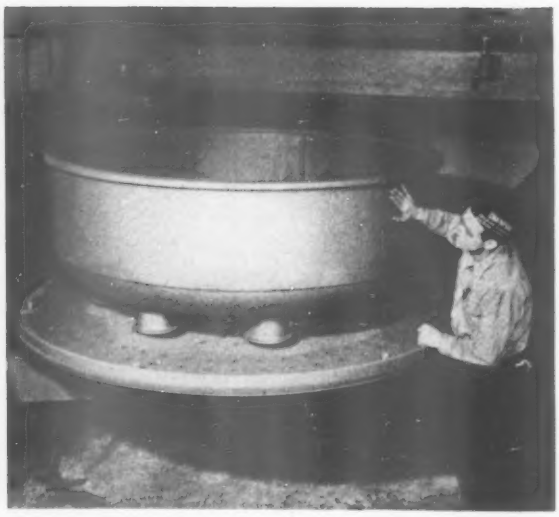
As for the gas: "We prefer to use carbon dioxide for shielding the arc column because our flux chemistry is of such a nature that we rely on this chemical analysis combining with the chemistry of the gas. Inert gas, however, can be used if the chemistry such gases do not have is provided for in the analysis of the flux."

As to the flux's chemical analysis, Mr. Bernard wasn't talking.

The present line of electrodes consists of three brands: "Types 1, 2 and 3." The most universal of the three—"Type 2"—has physical values that are comparable to those produced in welding various common steels with E-6012 electrodes. Diameter sizes are 1/16, 3/32, 1/8, 5/32, 3/16 and 1/4 in. The fact that it is a flux-cored rather than a flux-coated electrode enables it to be produced in larger diameters than are ordinarily possible in coiled electrodes.

The new process has been applied, both automatically and semiautomatically, on a production scale in the fabrication of liquid-storage tanks. The company expects to continue research on the equipment and process —Mr. Bernard isn't standing still despite his feeling that he has come up with an entirely new concept of welding.

LOADING a 1,500-lb steam dome onto the swing table



HERE'S how dome looks after three minutes' blasting

1½ hours cut to 10 minutes

Three minutes for shot blasting, seven minutes for preparation, loading and unloading. That's all the time it takes to clean above weldment by "airless" blasting.

McNeil Machine & Engineering Co., Akron, O., makes presses and vulcanizers for the rubber industry. There are very small welded items as well as bigger ones. The biggest, the pressure steam dome shown in the above pictures, weighs 1,500 lb and is 72 in. in diameter by 28 in. high.

For many years, the company had two men on each of three shifts performing chipping and grinding manually. The surfaces, although they met the minimum standards for cleanliness, did not satisfy the company's officials. Furthermore, a very bad dust condition was present in the plant as a result of the large amount of chipping and grinding that had to be done. And it was difficult to obtain men who were willing to do this type of work.

How different things are today since a swing table and blasting cabinet were installed! The large plain table is mounted on the door of the cabinet. As the door is opened, the table automatically comes out into the room for loading or unloading. A jib crane aids this operation when big weldments such as the steam dome must be handled. When the door is closed, the table automatically moves back into the cabinet and rotates during blasting.

In the left picture above, the 1,500-lb steam dome is being loaded onto the swing table. The table has a diameter of 86 in. to accommodate the 72-in. diameter of the dome. The heavy weldment is suspended from the hook of the jib crane, which lowers it into position. In the right picture, the dome has gone through the blasting operation and has emerged bright and clean. All rust, scale and weld spatter have been removed.

Wheels Throw Abrasive

Within the closed cabinet, steel shot abrasive is thrown centrifugally from two rapidly rotating bladed wheels: one in the roof of the cabinet and the other mounted in the side wall. Shot with a nominal particle diameter of 0.039 in. is used.

The large steam dome, which formerly required 1½ hours of manual grinding, is now cleaned in only ten minutes from start to finish. This time allows three minutes for the actual blasting and seven minutes for the various jobs of preparation, loading and unloading. The weldment needs to be positioned only once as the ricocheting shot reaches the underside and cleans that at the same time.

Instead of the steam dome, a table load might consist of three or four medium-size weldments or perhaps a large number of small parts. It makes no difference to the cabinet. All are cleaned thoroughly within two or three minutes of blasting per table load.

Manual grinding has not been completely eliminated by this new equipment. It is still necessary for the finer clean-up jobs. However, the number of grinding wheels consumed in the plant has been reduced two-thirds.

The closed cabinet has practically eliminated dust from grinding. A dust collector of the cloth-tube type allows no dust to escape into the plant and enter the lungs of the workers.

An interesting side benefit is that the quality of weldors' work has improved. Since all the slag, flux and scale are removed right down to the virgin metal, poor welds stand out like a sore thumb. Knowing that this will happen, the weldors take more care with their work. As an indirect result of the blasting installation, the testing department is now returning fewer pressure-type vessels to the welding department for the repair of leaks. Insurance inspectors approve.

Photos courtesy American Wheelabrator & Equipment Corp., Mishawaka, Ind.

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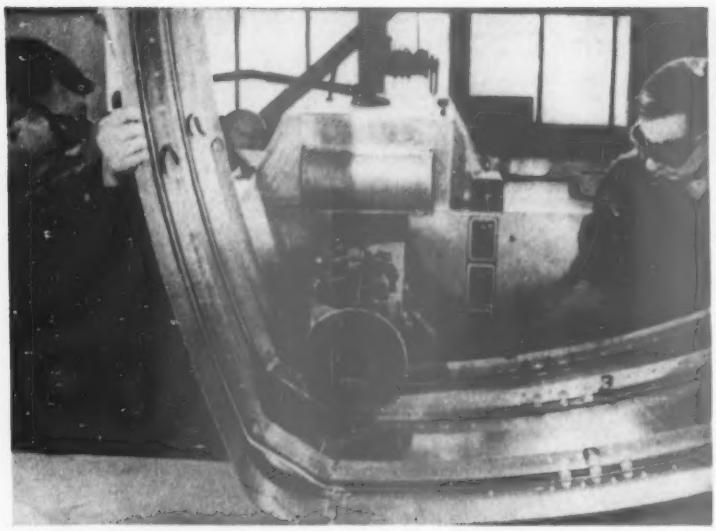
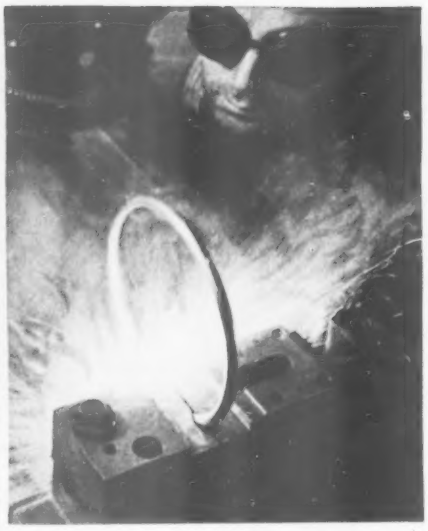


Aluminum Co. of America

SEAM welding stiffener rings in a gasoline tank of aluminum alloy. An intermittent (roll-spot) welding process is being used



Aluminum Co. of America

FLASH welding aluminum tubing into a ring—a difficult technical problem

How about welding the aluminum alloys?

Here's the detailed information you will need in resistance welding the aluminum-base alloys, equipment, preweld cleaning, machine settings and heat problems.

Part II: procedures for seam and flash welding

BY LESTER F. SPENCER

In last month's installment, Mr. Spencer gave full details of procedures for the spot welding of the aluminum alloys, including equipment, machine settings, test methods and other details. The present and final installment covers preweld cleaning and procedures for seam welding and flash welding.—The Editors.

THE CLEANING procedure for resistance welding of aluminum alloys that are to be spot welded will vary to some extent. In general, however, it consists of two steps: (1) a precleaning to remove surface contaminants such as grease, oil, marking ink, etc. and (2) a mechanical or a chemical cleaning procedure to remove the oxide film.

As explained last month, the surface film will start to re-form immediately after removal, and it will thus be necessary to determine the permissible time delay between cleaning and welding. The allowable delay will not only vary with the alloy type but will also vary, to even greater degree, because of the conditions under which the cleaned material is stored while it awaits welding.

Depending upon specific conditions, the oxide removal may be accomplished by either a mechanical or a chemical procedure. Mechanical cleaning makes use of rotating wire brushes. A typical set-up for brushing 24S-T Alclad of 0.040-in. thickness is as follows:[4]

Wheel diameter	4 in.
Bristle thickness	0.003 in.
Wheel speed	3,400 rpm

Precautions must be taken so as not to form deep scratches on the surface of the work. According to Mallory[4], the advantages of mechanical cleaning can be listed as: (*a*) removal of the oxide film without any danger of depositing another high-resistance film, (*b*) the ability to clean the surface selectively instead of treating the entire surface and (*c*) low equipment cost. The two disadvantages are: (*a*) relatively high labor costs and (*b*) difficulty in obtaining a uniform surface, particularly where different operators are doing the work.

Chemical Cleaners

Chemical cleaning avoids the second difficulty but presents a new problem: the chemical chosen may also attack the metal after the oxide has been removed. This necessitates very close control of all the variables involved in a chemical bath. Of the acid cleaners, hydrofluoric acid, in a concentration of from 1 to 3%, is probably the most effective means of removing the oxide film. However, it will attack the aluminum-base alloy and leave a high-resistance deposit of its own. An immersion of 30 seconds

Table V. Single-Phase A-C Settings for Gastight Seam Welds[5]
(Aluminum alloy 52S-H34)

Thickness of One Sheet, Inch	Spots per Inch	"On" Plus "Off" Time, Cycles (1)	Weld Speed, Feet per Min. (2)	"On" Time, Cycles		Welding Force, Pounds (4)	Welding Current, Amperes (5)	Width of Weld, Inch
				Min. (3)	Max. (3)			
0.010	25	3½	3.4	½	1	420	19,500	0.08
0.016	21	3½	4.1	½	1	500	22,000	0.09
0.020	20	4½	3.3	½	1½	540	24,000	0.10
0.025	18	5½	3.0	1	1½	600	26,000	0.11
0.032	16	5½	3.4	1	1½	690	29,000	0.13
0.040	14	7½	2.9	1½	2½	760	32,000	0.14
0.051	12	9½	2.6	1½	3	860	36,000	0.16
0.064	10	11½	2.6	2	3½	960	38,500	0.19
0.081	9	15½	2.1	3	5	1090	41,000	0.22
0.102	8	20½	1.8	4	6½	1230	43,000	0.26
0.128	7	28½	1.5	5½	9½	1350	45,000	0.32

(1) Use next higher full cycle setting if timer is not equipped to give antipole starting of current.
(2) Wheel speed is adjusted to give desired spots per inch.
(3) "On" time must be set at full cycle setting, if "on" plus "off" time is set at full cycle setting.
(4) Welding force and welding current are adjusted to give desired width of weld. Use lower pressures for 52S-O or 38-H14 alloys.
(5) Two to three gallons of cooling water per minute are required for electrodes and work.
This table may also be used as a basis for seam welding other alloys, with appropriate change being made in the pressure and current to produce the required width of weld.

within the bath may increase the contact resistance almost 400% as compared to a 5-second immersion period. Because the immersion period is so critical, this acid is not usually used on a commercial basis.

Hydrofluosilicic acid, in concentrations from 1.5 to 3.0%, is almost as effective as a hydrofluoric solution and is considered more practical inasmuch as the permissible immersion time is a matter of minutes rather than of seconds. This permits a wider margin of safety. In addition, the acid is readily available, inexpensive and the cleaning can be performed successfully at room temperature. There are several commercial cleaning compounds available that are also effective in eliminating the oxide film. As with the previous materials mentioned, the immersion time is an important factor to consider because of the rise of contact resistance when the immersion time is increased.

Seam Welding

Seam-welding procedures are very similar to those discussed under spot welding last month. The electrodes that are employed are of the roller or wheel type, having a diameter of from 6 to 9 in. and a thickness of from ⅜ to ⅝ in. One or both of these wheels are dressed to a one or two inch radius so as to concentrate the current in the weld.

A gastight seam weld can be produced by overlapping the spots made in seam welding. Also, "intermittent" or "roll spot" seam welding can be done by adjusting the timing. Intermittent seam welds may, in many instances, duplicate spot-welded joints from the service and the strength standpoints.

Seam welding can be accomplished by either a-c or condenser energy-storage machines. The current to make the weld may be applied while the wheels are moving or at rest; in the latter method, the machine drive is equipped with a geneva drive unit to stop the rolls at each weld location and the current is synchronized so that it is applied during this period. This method results in superior surface finish on parts.

As with spot welding, water cooling is essential. Sometimes this is provided by internal cooling, but the most common procedure is to allow water to flow copiously against the periphery of the wheel near the weld. The technique employed is similar to spot welding in regard to handling, precleaning, production of test specimens, etc. The speed of welding will vary with the thickness of material welded; from one to five fpm.

Machine settings for producing a gastight seam weld in a 52S-H34 aluminum alloy with single-phase a-c equipment are given in Table V. Electronic timing is the only satisfactory method of controlling the "on" and "off" cycles so as to obtain consistent weld strengths. The ratio of on-time to off-time[6] is stated to range from 1/5 to 1/3. The weld width should be about twice the thickness of material joined plus 1/16 in.[5] Excessive weld speeds produce a sticking action of the work onto the weld wheels. In wheel dressing, a sufficient coarseness of surface should be realized so as to prevent slippage between the work and the wheels.[3]

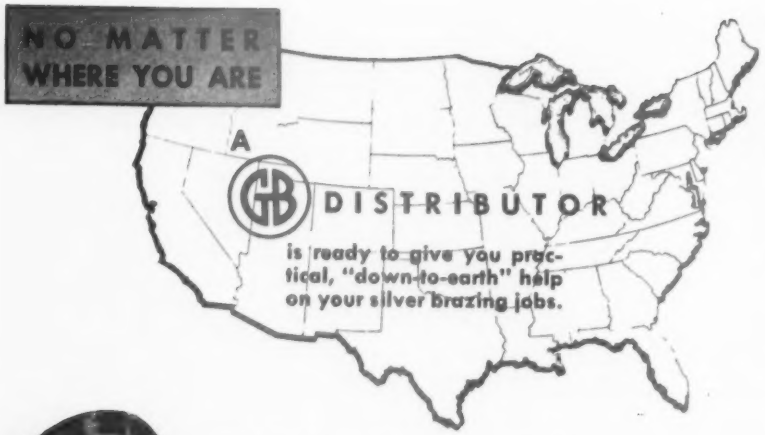
Flash Welding

Flash welding is employed to a large extent for the butt and miter joining of sheet, tubing, extrusions and rolled bars. With aluminum it is usually confined to such alloys as 2S, 3S, 53S and 61S and is usually limited in sections greater than 0.050 in.[6] The process is also quite adaptable to joints in dissimilar materials. As an example, aluminum and copper tubing can be flash welded, and the joints so produced will fail in the aluminum outside the weld.[6] The miter joint that is used will have an angle varying from 60 to 120 degrees.

The parts to be flash welded are securely clamped in suitable dies and are driven together with an accelerated motion. A predetermined voltage is maintained during the operation. As the parts touch, flashing results; the flash period is held from ½ to 1½ seconds, after which the parts are forced together. Both heat and pressure are responsible for the weld. Pressure is maintained until the weld metal has cooled. A rather large amount of upset metal is usually produced, and it must be removed. Where this is not done, failure may occur either in the weld or heat-affected zone.[3] In the flash welding of cold-worked material, lower strength values will be realized in the heat-affected zone adjacent to the weld as compared to the strength exhibited by the unaffected metal.

A machine for flash welding aluminum should have sufficient transformer capacity to supply a current density of 100,000 amperes per square inch[3] in the section where the parts are in contact. The secondary voltage may be from 2 to 20 volts, and the upset pressures may vary from 20,000 to 30,000 psi.

Die spacing is quite important; the value recommended for sheets and tubing is approximately 1½ times the thickness of sheet or tube wall.[6] If this factor is too small, an abrupt change in section between weld and the rest of the metal part will occur and may result in rapid die wear. Too large a die opening will result in low effective upset pressures, overheating and buckling. The upset motion is usually from 1/16 to 3/16 in., depending upon the section welded. In addition, a uniform accelerated motion will aid in obtaining an even flash. Too high a velocity at the end of flashing will cause freezing of the parts.[6] The maximum velocity should be at least twice the flashing velocity[3]



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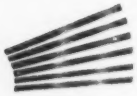

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at the beginning of the upset motion. This maximum upset velocity should be reached in from 1/60 to 3/60 seconds. The total material flashed off will be dependent upon the sectional diameter; for small diameters it is around ¼ in., for larger diameters about ¾ in.

It is expensive to construct the special dies to hold the parts, and time and material must be expended to adjust the flash welder to produce optimum welds. For this reason, economical use of flash welding usually requires that from 500 to 1,000 joints be made[3]. Production rates from 60 to 200 welds per hour are obtained, depending upon the method of clamping the parts.

References

[1]*Procedure Handbook of Arc Welding Design and Practice*, The Lincoln Electric Co., Cleveland.

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[4]*Spot Welding Aluminum Alloys*, 1948 ed., P. R. Mallory & Co., Inc., Indianapolis.

[5]Bulletin Number 18, "Aluminum Welding," 1953, Resistance Welder Manufacturers' Association, Philadelphia.

[6]Resistance Welding Manual, 1948 ed., Resistance Welder Manufacturers' Association, Philadelphia.

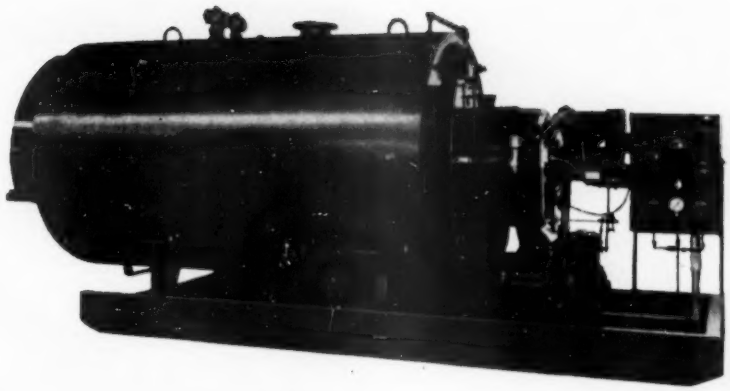
[7]"Resistance Welding of Aluminum and Its Alloys," L. F. Spencer, *Industrial Sheet Metal*, Jan. and Feb., 1951.

3 TONS MORE PAYLOAD

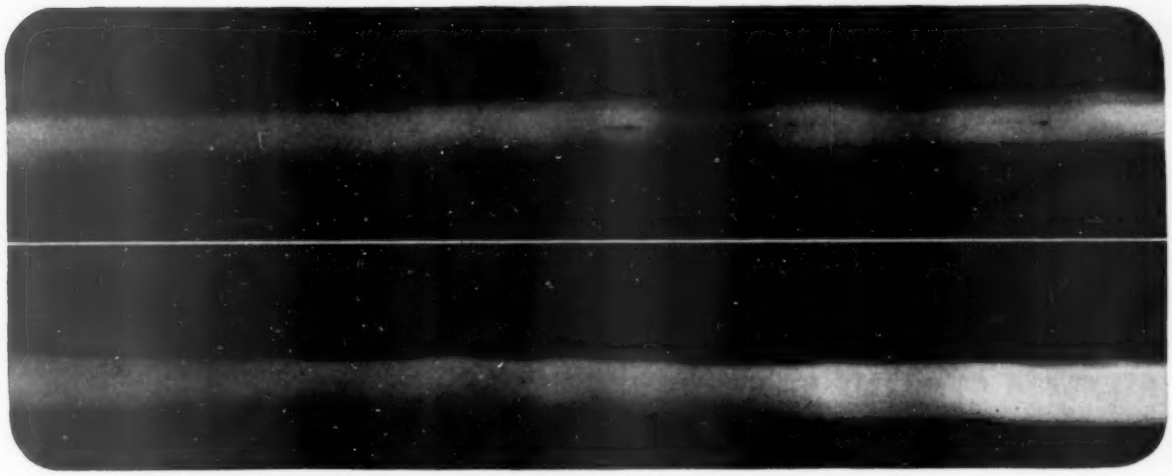
(Continued from page 30)

similar, part for part. Therefore, it is impossible to compare weights on all items that were welded. But the weight reduction made possible through welded design on the flame and hoist drums is highly significant. The table at the beginning of the article gives the respective weights in pounds for each main item.

Live load (bucket plus payload) is 34% greater for the new trolley than for the old. In addition to the sizable weight reduction made possible by welded design, other weight savings were achieved by using aluminum alloy for the control house, platform, hand railing and miscellaneous brackets. The hoisting and traveling speeds also were increased by using motors that gave greater horsepower without increase in weight. All these factors increased the overall free digging capacity of the new trolley by 72% over the old one.



WEIGHT DOWN 15%—COSTS DOWN 10%



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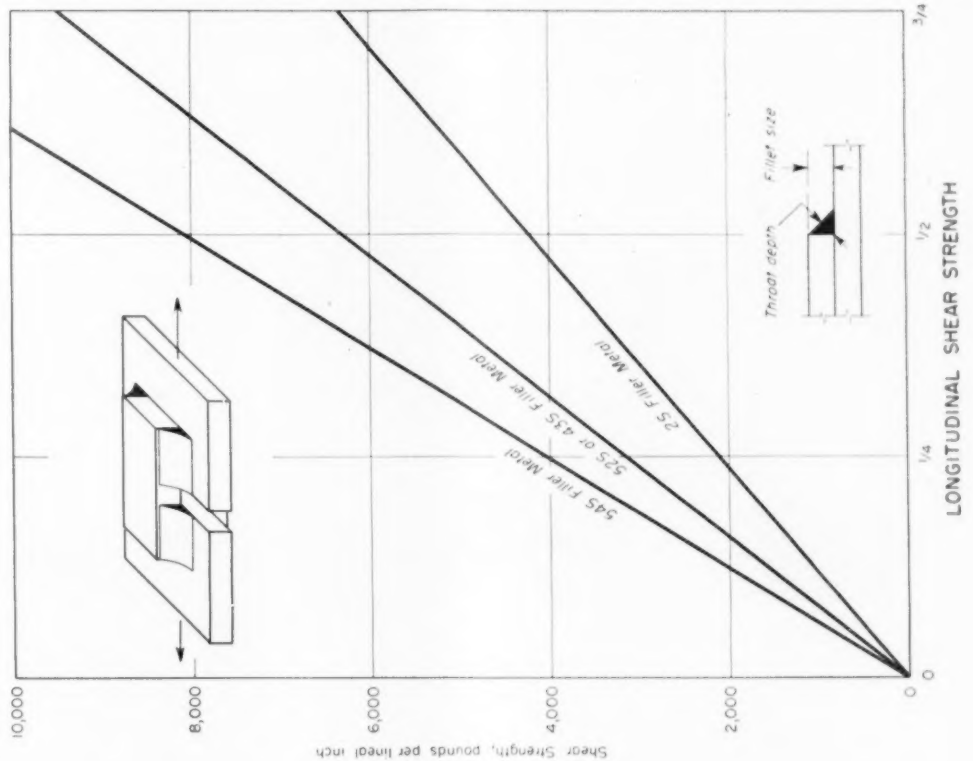
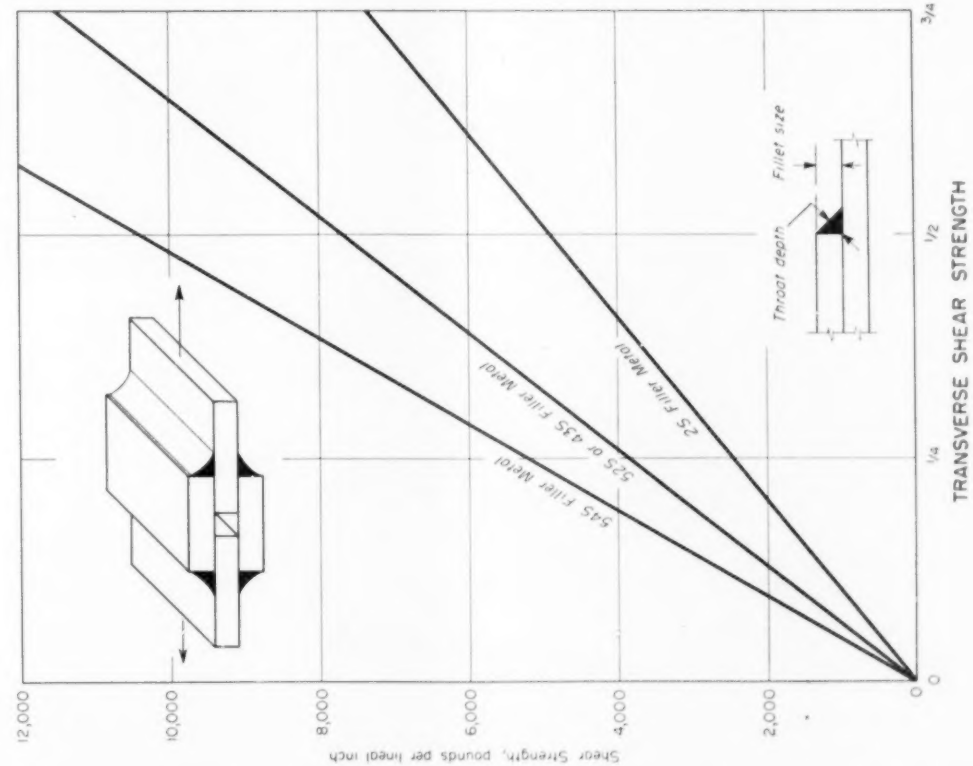
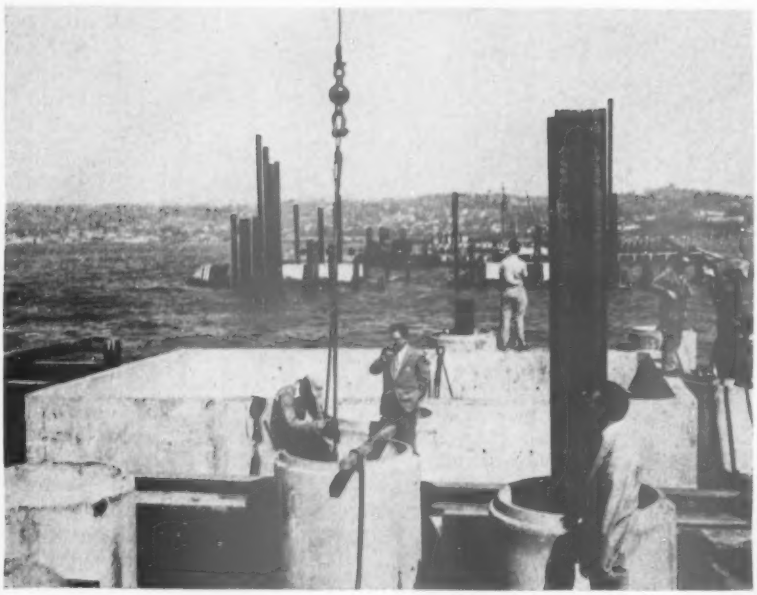
Approximate Shear Strengths of Aluminum Fillet Welds





From "Welding Alcoa Aluminum." Copyright 1954 Aluminum Company of America

on the job . . .



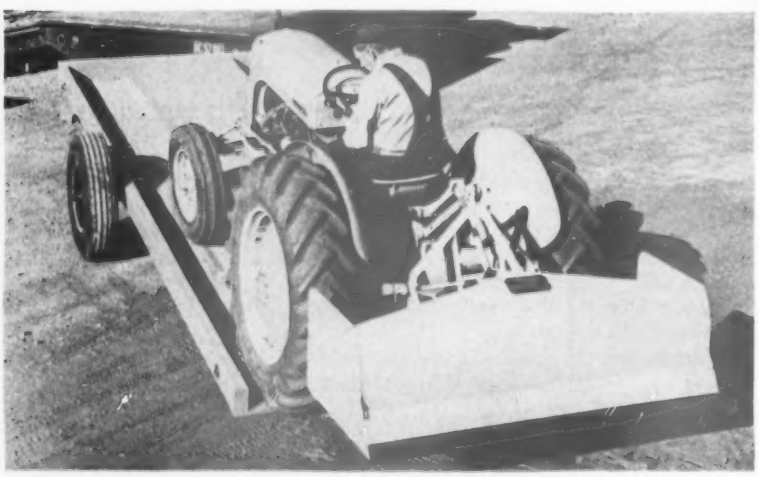
Courtesy The K-G Equipment Co. (Inc.)

He's down in a well

INTERESTING part of above picture is what you don't see. This procedure is said to open up a completely new concept of bridge footing construction.

In building the $60,000,000 Tappan Zee Bridge across the Hudson River between Tarrytown and South Nyack, N. Y., 7 by 12 in. H-beams are driven approximately 300 ft down through the caissons into the river bed. When the driving of a beam is finished, it projects above the caisson approximately 15 ft. The beam is then cut off 26 ft *below* the top of the caisson.

Not shown in the picture, the man doing the flame-cutting is in the concrete well, 28 in. in diameter, that surrounds the H-beam. In the caisson at left, the H-beam has already been cut and at right is the H-beam that will be cut next. The torch is lowered into the hole by a crane operating from a barge.



Easy loading and 600 lb less weight

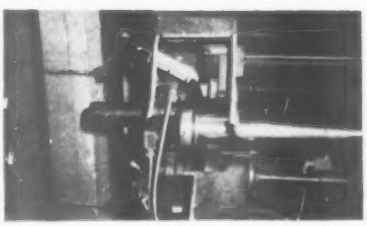
By Bert Goldrath

THE CONVENTIONAL trailer for hauling farm tractors of the wheeled type is a platform mounted on beams for strength. It weighs 1,800 lb. The Bob Hipp Welding Co., Menlo Park, Calif., has developed an all-welded beamless trailer that weighs only 1,200 lb.

Measuring 16 ft by 74 in., this trailer is only 17½ in. high, providing a low center of gravity for heavy equipment. It is formed of ⅛-in. plate. Tires are 7.50 by 16 eight-ply nylon on a 3,000-lb rated axle. Most wheel-type tractors can be accommodated in the 16-in. wide channels for treads.

It takes 40 pounds to tip the trailer, and when one end is down it will remain tipped. The hitch is designed so that a forward pull brings the platform to a level position. The bed will remain level even if the lock should come open while the vehicle is in transit. The tail end is only 1½ in. above ground when depressed.

Mig and



Tig team up

OVER a million cartridge tanks have been produced by The Aluminum Goods Mfg. Co., Wisconsin manufacturer of aluminum products. Blanks are stamped out of sheet aluminum, cleaned and formed into open cylinders about 4½ in. in diameter. The formed blanks are then fed into a modified tube welder (upper picture). Mig (metal inert-gas) welding of the longitudinal seam is done at speeds up to 200 ipm (upper picture).

Tig (tungsten inert-gas) welding is used to weld a cup of 10-gage aluminum to one end of the tube (lower picture). Each weld is completed in an average time of 12½ seconds at speeds up to 60 ipm.

Photos courtesy Linde Air Products Co.

Welding Info-Aids . . .

1 WELDING ACCESSORIES—Metal & Thermit Corp. 22-page catalog fully illustrates and describes arc welding accessories. Line includes electrode holders, helmets, eye shields, ground clamps, cleaning tools, welding cable, gloves and other related items.

2 TORCH ATTACHMENTS—Air Reduction Magnolia Co. Bulletin ADC 837 tells of new cutting attachments and jet-type mixer that are said to extend greatly the cutting, welding and heating range of "Airco 800" general-purpose oxyacetylene torch.

3 RESISTANCE ANALYZER—Chemical Research Associates. Leaflet pictures and describes new portable surface-resistance analyzer for accurate measuring of aluminum interfacial sheet-to-sheet resistance in connection with resistance welding. Unit is portable, weighs only 30 lb.

4 PIPE FITTINGS—Ladish Co. 304-page Catalog No. 55 provides detailed specifications on complete fittings line and useful technical data to help solve piping problems. Includes 68 pages on butt welding fittings, seven pages on long welding neck flanges.

5 WELDING GOGGLES—Watchemoket Optical Co., Inc. Illustrated 1-page leaflet describes three models of welding goggles—"Stac-Vent 492" and "490" and "Visor-Tuc 425." Ventilation in "Stac-Vent" series drafts off moist air from inside goggle, eliminating fogging.

6 WELDING ACCESSORIES—Albert & J. M. Anderson Mfg. Co. 12-page Catalog 49C illustrates and describes applications of welding ground clamps, cable connectors and other accessories. Specifications and dimensions are included.

7 TUNGSTEN ELECTRODES—North American Philips Co., Inc. 4-page brochure (Form No. B1357) gives specifications of "Elmet" pure-tungsten and thoriated-tungsten electrodes for atomic-hydrogen and inert-gas, arc-welding processes. Includes three charts.

8 WELDING PLATENS—Acorn Iron & Supply Co. 4-page brochure pictures and describes welding platens (or bending blocks) and stands. Also illustrated are accessories such as hold-down jog, arm clamp and tapered drift pin used to hold work on platens.

9 STUD WELDING — Nelson Stud Welding Division. New instructions on paralleling two units for welding large-diameter studs are among changes in revised "Nelwelder" Power Unit Manual No. 8. Unit is designed for stud welding and is not usable for conventional arc welding. Manual includes directory of more than 190 field service shops and firm's offices, warehouses and distributors.

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10 WELDING CURTAINS—Industrial Products Co. Leaflet (A-12) pictures and describes curtains designed to confine welding operation to a given area. Constructed of special flameproof and waterproof canvas or asbestos, curtains also serve as shield against flying chips and scale when cleaning is being done.

11 FLUXES—The Lincoln Electric Co. "New Development in Fluxes for Automatic Welding and Hard Surfacing" is title of 4-page illustrated reprint from *The Welding Journal*. The author, L. K. Stringham, presented this paper on agglomerated fluxes at the AWS meeting in Cleveland last fall.

TO OBTAIN: manufacturer's catalog or bulletin described on this page, use the card sections printed below. Insert number of the item or items that interest you. WELDING ENGINEER will ask manufacturers to send the information requested.

Each card section must be completely filled out. Do not use ditto marks. These cards are not good after Oct. 1, 1954.

How to obtain manufacturers' literature:

Fill out card section and write in number of item as shown at right:

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Name John Smith
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CHICAGO 11, ILL.

12 CONTROL VALVES—Vickers Inc. 4-page bulletin (53-35) describes "Microfeed" flow control valves for welding machine oil hydraulic systems. Flow-control circuits, performance curves, installation data and complete specification tables are given.

13 BLAST CLEANING — American Wheelabrator & Equipment Corp. Blast cleaning by airless means in tumble-type machine is subject of new bulletin. Specifically described is 11½-cu-ft-capacity "Tumblast" model. Unit has many applications.

14 HELMET ATTACHMENT — Davis Emergency Equipment Co. Special bulletin describes "Speedy Attachment" for connecting face shields and welding helmets to caps of any size or shape, resulting in various shield-helmet-cap combinations. Helmet or shield is firmly secured to cap by means of patented clip held in tension under rim of cap by adjustable band which crosses top of cap.

15 POSITIONER — American Equipment Co. Folder describes new bench-model welding positioner, which is available with hand or power table tilt. Positioner operates on 110 volts, a-c, 60 cycles. Takes work up to 100 lb.

16 MAINTENANCE — Eutectic Welding Alloys Corp. 16-page illustrated manual on equipment maintenance and repair is slanted toward sugar industry but should be of value to others. Each case history represents problem that was solved with soldering, brazing or welding materials and procedures.

17 WELDING ELBOWS—Taylor Forge & Pipe Works, Inc. Bulletin 534 is 24-page illustrated reprint of paper presented at recent meeting of ASME. Entitled "In-Plane Bending Properties of Welding Elbows," the paper's purpose is to provide design engineers with accurate, experimentally derived flexibility and stress intensification factors applicable to welding elbows commonly used in high-pressure steam, oil-refinery and gas-compressor station piping systems.

18 ARC WELDERS — Birdsell Products. 6-page pamphlet pictures and gives specifications of firm's line of a-c arc welders, which feature stepless amperage control. Price list is included.

19 GROUND CLAMP—Jackson Products. 2-page leaflet (Form GC) gives price list of improved welding ground clamps. Also includes description and illustrations.

20 WELDING, CUTTING—K-G Equipment Co., Inc. Catalog No. 54 E has 20 pages illustrating welding and cutting torches, attachments, tips, mixers, adapters, etc. Color catalog has 4-page insert listing equipment prices.

21 FLUX COATING — Easton Metal Powder Co., Inc. Firm's modern plant and production operations are described in illustrated bulletin. Product line includes various grades of powder for flux coating of welding electrodes, flame cutting and scarfing.

22 STAINLESS ALLOYS—The Cooper Alloy Foundry Co. Eleven reference sheets covering the major stainless alloys comprise new technical booklet. Information given for each alloy includes weldability, heat treatment, chemical composition and mechanical and physical properties.

23 HARDFACING—Coast Metals, Inc. 2-page booklet lists applications, description and characteristics of "No. 170" electrode, containing molybdenum, boron and iron.

24 WELDING COPPER—Revere Copper and Brass Inc. "Techniques in Welding Copper" is title of 24-page illustrated booklet that discusses oxyacetylene, carbon-arc and metal-arc methods used in joining copper.

25 SHOCK ABSORBERS—J & H Products Co. 2-page illustrated leaflet tells of "Vibration Dampeners" for right-angle head grinders, air or electric. Operator fatigue is said to be reduced by this shock absorber because the bounce and fight are taken out of grinder.

26 CYCLE TIMER — Vacuum Tube Products. Leaflet describes fractional cycle timer designed to meet more specialized requirements of resistance welding when used for timing spot or seam welders.

27 HARDFACING—Crobalt, Inc. Leaflet (Bulletin 102) describes and gives specifications of "Crobalite" hardfacing alloys, which are cobalt-chromium-tungsten alloys in solid welding rod form. Typical applications are listed.

28 PIPELINE REGULATORS — Air Reduction Sales Co. Catalog ADC 705 describes new "8900" series of regulators, designed for use with gases supplied by pipeline systems using comparatively low pressures. These new oxygen cutting and welding regulators are said to afford greater flow capacities than the "8600" series, which they supersede.

29 SELENIUM RECTIFIERS — Fansteel Metallurgical Corp. 24-page illustrated booklet is entitled "Fansteel Selenium Rectifiers—Engineering Information Bulletin 6.400." Contains information useful to design engineers and lists standard cell sizes and ratings, typical rectifier circuits, operating principles and typical applications with circuit diagrams.

Insert number of item on card section. Fill out each card section completely —do not use ditto marks.

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HARRIS

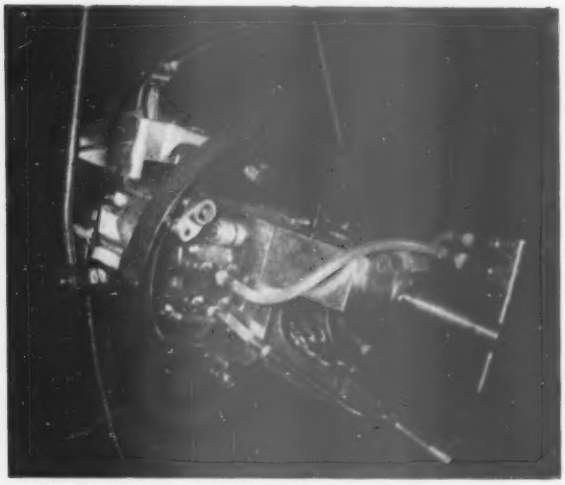
Send for Key to Revolutionary Method of Increasing Profits and Quality of Gas Welding and Cutting. Folder No. WE-6

THE HARRIS CALORIFIC COMPANY

5501 CASS AVENUE, N.W. CLEVELAND, OHIO

SERVING THE METAL INDUSTRY SINCE 1905

New products . . .



SPOT welder has pressure adjustment up to 500 psi

WEIGHING only 65 lb, arc welder is easily portable

Spot welder

SPRING pressure as well as jaw opening is adjustable on new imported spot welder manufactured by Machines A Souder Aro Co., of Paris, France. The welder cannot be fired before maximum pressure between the tips is attained. Preset pressure and welding time is said to insure 100% uniform welds. Extra heavy-duty flexible cable between gun and timer allows complete freedom of movement.

Both air and water-cooled machines are available. Since arms and transformer are incorporated into one unit, current losses associated with suspended equipment are said to be eliminated. Secondary current output for various models is 4,000, 6,000 and 8,000 amp.

ARO SPOT WELDERS, 87 Hamilton Pl., New York City 31.

* * *

Weld insert

DEVELOPED by Electric Boat Division of General Dynamics Corp., this "EB" weld insert refers to a welding process as well as to a specially shaped material used in the process. Insert is completely fused by a conventional inert-gas-shielded, tungsten-arc torch. The process permits deposition of a root pass that is smooth and uniform on both sides although actual welding is done on one side only.

Manufacturer claims first success of the process has been in welding stainless-steel pipe and further states there are certain advantages provided by the method that cannot be obtained with the standard backing-ring type joint or with inert-gas methods using no backing ring.

The new process is said to provide crevice-free welded joints frequently required in corrosive or high-temperature service.

Without a backing ring of any sort, it is difficult even for experienced weldors to control inside bead contours. Selection of proper analysis of weld insert offers an opportunity to control the weld metal deposit, thus avoiding weld cracks and providing the required strength and corrosion resistance.

ARCOS CORP., 1500 S. 50th St., Philadelphia 43.

* * *

Welding torch

ALTHOUGH weighing only 11 oz, including mixer, a new torch is said to be more rugged than any heretofore available in the medium-duty field. "Torchweld 45" can be used to weld steel from 28 gage to ½ in. thick, making it particularly suitable for pipe welding, automotive welding and sheet-metal fabrication.

The torch has a solid aluminum handle with integral valve body and brass tubes. Valve wheels positioned at the front of the handle allow instant adjustments with the torch hand. Two complete series of swaged welding tips, one-piece and screw-in style, are available in 12 sizes.

NATIONAL CYLINDER GAS CO., 840 N. Michigan Ave., Chicago 11.

Portable arc welder

RECENTLY developed, high-efficiency transformer is said to result in this portable arc welder doing the work of a conventional welder four or five times its size. The welder operates on either 110 or 220 volts, a-c, 60 cycles, with a rated output of 200 amp.

It will braze, cut and preheat as well as weld steel up to and including 1½ in. thick. The welder will handle electrodes from 3/64 in. up to and including 5/32 in., using either metallic or carbon-arc process. It is housed in a cast-aluminum case. Dimensions are approximately 11 in. by 12 in. by 7½ in. Comes supplied with 7 ft of cables, electrode holder and ground clamps. Manufacturer is Brennan, Bucci and Weber, Inc.; distributor is

KASSON DIE & MOTOR CORP., 32-14 Northern Blvd., Long Island City, N. Y.

* * *

Cold solder

METAL filler that hardens into metal itself can be spread by a spatula, putty knife or rubber squeegee. It is a cold solder with a tensile strength of 650 psi. Once hard and dry, the product stands temperatures up to 360 F and is not affected by cold to —40 F, according to the manufacturer. It will form a permanent bond with any metal, wood, plastic or glass, state further claims.

The filler consists of aluminum, an organic stabilizer and solvent. It comes in 1-lb cans.

ALL-STATE WELDING ALLOYS CO., INC., 249-55 Ferris Ave., White Plains, N. Y.

Tig welding torch

"HALO-ARC" torch is for use in Tig (tungsten inert-gas) welding. Large, self-contained water jacket with no gaskets allows water to circulate to top of body, insuring cool operation at all times, according to manufacturer.

Operator has to contend with only two separate parts—the interchangeable collet and the screw-in tailpiece, which acts as gas seal and locking device for the collet with tungsten electrode. Insulation is silicon glass. Hose connections are of the nut and nipple type.

MODERN WELDING MACHINE & EQUIPMENT CO., 87 Hamilton Pl., New York City 31.

* * *

Backing rings

CERAMIC backing rings for use in pipe welding are adaptable for both field and shop fabrication and are said to help produce faster and better welds. They are easily removed when weld is complete. They are said to assure complete but not excessive root penetration, prevent icicles and weld spatter.

The rings form smooth, uniform, light beads inside the pipe. Grooves in the rings prevent aforementioned difficulties. Available in several types for various pipe applications.

CHEMICAL EQUIPMENT DIVISION, General Ceramics Corp., Keasbey, N. J.

* * *

Pressure regulators

NEW line of pressure regulators includes those made in ¼, ⅜ and ½-in. pipe sizes, either with or without connections for pressure gages. Body parts are brass forgings, permitting use of inlet pressures up to 400 psi. Various reduced pressure ranges are available.

Valve is self-aligning and fully guided. Metal diaphragms are used.

GENERANT ENGINEERING CO., 260 S. 20th St., Newark 3, N. J.

* * *

Temperature sticks

"TEMPILSTIKS" for 413 and 438 F are now available. This makes it possible to obtain the temperature indicators in 12½-deg intervals from 113 to 450 F; in 25-deg steps in the 450-550 F range; and in 50-deg intervals from 550 to 2,000 F.

Now undergoing development are crayons for 463 and 488 F, according to a company announcement.

TEMPIL CORP., 132 W. 22nd St., New York City 11.

Now—a new line-up of PAGE welding wire in coils, reels, packages

• Here are some of the ways PAGE welding wires are packaged to protect them during shipment and to make it easy for you to handle and stock them. Two new packages are Leverpaks and pallet-mounted coils.

LEVERPAKS • Here's one of the best containers for coils up to 16" ID. It's light-weight, but durable. It is sealed air-tight and is packed with moisture-absorbing substance to reduce corrosion. Release safety catch, pull lever, and the whole top comes off. It's just as quickly resealed. Leverpaks can be rolled easily. They stack perfectly and take a minimum of floor space. They cost you nothing extra and have many re-uses.

PALLET-MOUNTED COILS • If you have a fork-lift truck, you'll like PAGE'S new pallet-mounting of 22" ID coils. Steel strapping and paper wrapping protect coils and hold them securely. You can run them in and out of freight cars and trucks, and spot them in your plant.

AUTOMATIC WELDING WIRES • **Inert Gas**—Six PAGE-ALLEGHENY stainless grades in .035", .045", and .0625" diameters. Precision thread-wound on 25-lb. non-returnable reels to fit popular arc welding machines. **Submerged Arc**—PAGE Stainless in wire diameters from 1/32" to 5/16", plain or copper coated. In layer-wound coils or 22" or 24" mill coils.

GAS WELDING RODS • In a variety of analyses: stainless, Armco, medium and high carbon, and manganese or naval bronze.

Warehouse stocks in Chicago, Denver, Houston, Los Angeles, San Francisco

Write our Monessen, Pa., office for literature and prices

ACCO

Page Steel and Wire Division

AMERICAN CHAIN & CABLE

Monessen, Pa., Atlanta, Chicago, Denver, Detroit, Houston, Los Angeles, New York, Philadelphia, Portland, Ore., San Francisco, Bridgeport, Conn.

A-c welder

FOR use on a wide range of a-c welding production jobs is the "Fleetwelder Special," a new welding machine available in 300, 400 and 500-amp, NEMA-rated, sizes. A free circuit reactor control, which is separate from the main transformer, can be adjusted continuously through a wide range of welding currents.

Machines are equally adaptable to sheet steel or heavy plate and are built for heavy duty, manufacturer states. Frame, core and case are welded steel; copper windings have spun-glass, refined-asbestos and mica insulation and mica separators. Current-control mechanism operates through double-reduction gear drive with a ball bearing shaft, permitting rapid selection with ease and trouble-free operation, it is claimed.

THE LINCOLN ELECTRIC CO., 22801 St. Clair Ave., Cleveland 17.

* * *

Flux

SOUND welds are said to be produced on stainless and alloy steels when this new flux is combined with a new stainless-steel wire in submerged-arc welding. Use of "Arcosite" flux and "Chromar" wire together is designed to give metallurgically controlled weld metal compositions. Manufacturer believes this marks the first time a way has been found to weld stainless successfully by the submerged-arc process.

Particle size of the flux is so controlled that substantially all passes through a 14 mesh screen with practically all held on a 100 mesh screen. This particle control is said to assure uniformity of arc action, alloy recovery, bead penetration and shape and easy flow through flux-feeding devices.

ARCOS CORP., 1500 S. 50th St., Philadelphia 43.

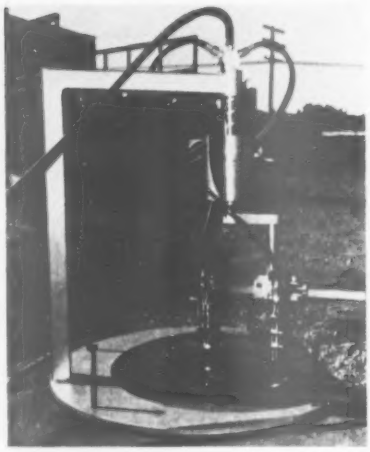
Buildup Rod

IMPROVED low-melting overlay for frictional-wear resistance on ferrous and non-ferrous metals is "EutecRod 186," which is recommended whenever a copper-base alloy is required. It can be used for building up or overlaying steel, cast iron, copper and alloys of copper and nickel.

Low heat of application—1,400 to 1,600 F—is said to minimize danger of distortion and warpage. It is available as bare rod or with specially formulated flux coating.

EUTECTIC WELDING ALLOYS CORP., 40-40 172nd St., Flushing 58, N. Y.

* * *



Flame-cutter

NO outside power source is required on "Tor-Kon-Vertor" flame-cutting machine. Cutting speed is hydraulically controlled. It has a built-in centering locator and will cut diameters of 0 through 60 in. Manufacturer claims concentric circles are cut with precision. Machine is said to be ideal for field use. Available in three models.

SUPERIOR WELDING AND MACHINE CO., Bartlesville, Okla.

* * *

Contact electrode

HIGH-speed electrode, "Rocket No. 24," is for horizontal and downhand welding. Best suited for faster welding on mild and medium-carbon steel, the electrode is recommended for operations requiring AWS classes E-6012 and E-6020; e.g., machinery, low-pressure storage tanks, light structural work.

Manufacturer states it produces a high-quality weld with a finely rippled bead approaching the appearance of a submerged-arc weld.

HOBART BROTHERS CO., Dept. RE, Troy, Ohio.

Arc-welding benches

NEW series of arc-welding benches with 36½ in. square tops will stand without end or wall supports. They are fitted with a 30-in.-high glare shield on three sides. Bench surface is 33⅝ in. high, and they come equipped with a bench drawer 18 in. by 22 by 5 in. and a shelf with partitions for holding welding rods. Although not furnished as standard equipment, fire brick can be easily installed on top.

INDUSTRIAL BENCH AND EQUIPMENT MFG. CO., INC., 98 South St., New Britain, Conn.

* * *

Ground clamps

REDESIGNED to fit the hand, arc-welding ground clamps are said to work easier and faster and open wider to grip workpiece. New angle of cable socket reduces strain on the cable. Provision is made for additional fastening of cable in back of socket to further reduce cable damage.

Large, flat contact area of copper-alloy upper tong has been retained. Clamps are made in three models to fit cable sizes 4 through 4/0.

JACKSON PRODUCTS, INC., 31739 Mound Rd., Warren, Mich.

* * *

Helmet attachment

"SPEEDY Attachment" makes possible new line of face shield and welding helmet cap combinations. The device is a clip that is held in tension under the rim of the cap by a tough, adjustable neoprene band, which crosses top of the cap. Shields and helmets can be connected to caps of any size or shape.

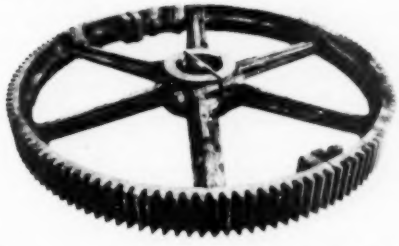
DAVIS SAFETY DIVISION, Davis Emergency Equipment Co., 45 Halleck St., Newark 4, N. J.

FAST REPAIRS OF HEAVY PARTS with THERMIT

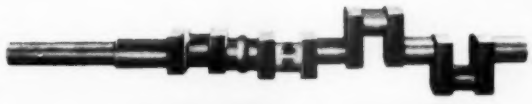
- Cuts downtime
- Eliminates costly replacement
- Repair outlasts original unit

Heavy machine frame repaired by Thermit Welding.

Thermit is used extensively for pinion gear repair.



3 fractures in this large ring gear were quickly repaired by Thermit Welding.



Crankshaft, 8" in diameter, was restored to duty by Thermit after being broken.

When industrial equipment breaks down, the most important problem is to get it back in service—and FAST! Thermit Welding has answered this need time and again . . . in a variety of plants . . . for a variety of parts. Thermit requires a minimum of technical skill . . . gives consistently sound welds . . . is more economical than part replacement. Thermit repairs are permanent repairs.

Investigate THERMIT® WELDING

always ready to work for you

DETINNING •
THERMIT WELDING •
METALS & ALLOYS •
ARC WELDING—*Materials and Equipment* •
CHEMICALS & ANODES *for Electrotinning* •
CERAMIC OPACIFIERS •
STABILIZERS *for Plastics* •
TIN, ANTIMONY & ZIRCONIUM CHEMICALS •

METAL & THERMIT CORPORATION

100 EAST 42ND STREET • NEW YORK 17, N. Y.

Newark, N. J. • Pittsburgh, Pa. • E. Chicago, Ind.

So. San Francisco, Cal. • Philadelphia, Pa. • Toronto, Canada

Portable a-c welder

PORTABLE welding unit gives localized heat of variable intensity for joining sheet and strip with filler rod or for hardfacing or soft soldering. Manufacturer claims the high concentration over small area enables repairs to be made to metal parts incorporating combustible materials.

Heating element is a carbon electrode held in holder with a head swiveling through 180 deg. Weight of unit is 22 lb.

G. K. LANCASTER (LONDON) LTD., 50 George St., Croydon, Surrey, England.

* * *

Multiple grinder

THREE or more "Grind-O-Flex" grinding wheels may now be mounted together to form a single broad wheel which acts on a much larger area. Any number of these units may be assembled together as required in increments of 1 in. for fixed installations.

When attached to a flexible shaft or portable drill, three to five wheels are recommended for best results. Because these wheels are light in weight, such grouping is practical. They follow irregular contours.

MERIT PRODUCTS, INC., 4023 Irving Pl., Culver City, Calif.

* * *

Cycle timer

FRACTIONAL cycle timer is designed to meet the more specialized requirements of resistance welding when used for timing spot or seam welders. Fast time setting is said to insure spatter-proof, oxide-free welds and allows positive welding of such materials as molybdenum and tungsten.

The "VTP Model F-216" timer is packaged in compact unit measuring 10½ by 9 by 10½ in. All controls are accessible from front panel. Weld time is adjustable from about 1/6 to nearly ½ cycle, with option of utilizing reverse part of the cycle.

Peak output of standard unit is 40 amp. Operation is from 220-volt, three-wire, 50-60 cycle source.

VACUUM TUBE PRODUCTS, 506 S. Cleveland St., Oceanside, Calif.

Head manipulator

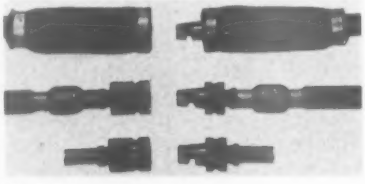
METHOD for converting portable semiautomatic flux-type welding head into highly productive tool is provided by new welding head manipulator, manufacturer claims. Technically known as the "Semiautomatic Manipulator," it will be called "Sam" for short.

Its application are many. It makes longitudinal and circumferential welds on tanks, welds on items too large and bulky for positioners to handle and on positioned weldments.

The unit is available with either hand or power lift for raising the weld tip to an arc height of 7½ ft above floor line. Horizontal arc travel is 8 ft. Fully reversible, infinitely variable-speed boom makes possible welding speeds from 0 to 120 ipm in either direction. Available on fixed base or on casters.

PANDJIRIS WELDMENT CO., 5152 Northrup, St. Louis 10.

* * *



Cable connector

NEWLY designed "Taper-Lok" quick connector for arc welding is attached to the welding cable by the "Cadweld" process, which the manufacturer claims insures 100% electrical conductivity. Although easily disconnected, the connector's positive locking action is said to prevent pulling apart in service. Durable rubber insulators are anchored to welding cable.

Its 500-amp capacity makes it suitable for many types of operating conditions. Stud is replaceable.

ERICO PRODUCTS, INC., 2070 E. 61st Pl., Cleveland 3.

Hardfacing rod

MULTIPLE-pass feature is said to be outstanding characteristic of "BR" hardfacing rod, developed specifically to withstand combination of extreme abrasion and heavy impact. It is available for either electric or acetylene applications.

Worn parts originally rebuilt with the rod can be rebuilt over and over again with new metal forming a permanent bond with the previous "BR" deposit. Time of application is said to be reduced because a fast burn-off rate is provided by the perfect balance of the rod's high alloy content—chrome, nickel, molybdenum and tungsten.

MIR-O-COL ALLOY CO., 312 North Avenue 21, Los Angeles 31.

* * *

Air clamp

AIR-actuated C clamp is said to increase production 25% or more on bench and tool work. The standard "Kajon" clamp has an opening of 6 in., with 3-in. throat and 2-in. plunger travel closing to shut position with 700-lb thrust on line pressure of 100 lb.

Air chamber and valve are integral part of clamp at base, where turn screw and handle are located on manual C clamp. Lever valve on the air chamber controls release and gripping action of the clamp.

THE BURKLYN CO., 3429 Glendale Blvd., Los Angeles.

* * *

Solder flux

DEVELOPED to afford a soldering flux for every purpose, this new and extended line of external fluxes ranges from the mild, non-corrosive type to the strong, highly active, stainless-steel type. All are said to give maximum wetting, rapid fluxing power and minimum corrosive after-effects.

Supplied in quart and gallon bottles with informative labels.

ALPHA METALS, INC., 56 Water St., Jersey City 4, N. J.

Here's evidence of the superior flashback* resistance built into PREST-O-WELD TRADE-MARK BLOWPIPES

This is an actual excerpt from a recent Salesman's Report:

"... The superintendent wanted to know what the PREST-O-WELD *W-122 blowpipe's characteristics were concerning flashback. I told him to go ahead and try it. He then lit a standard welding head and placed it against a block of wood six inches square. It bit its way into the block two inches deep before the tip of the welding head began to melt off. BUT ALL THE WHILE IT KEPT BURNING WITH NO FLASHBACK...."*

We don't guarantee that every blowpipe can be maltreated this way with the same results. But that's the simple truth about the flame stability and flashback resistance of the PREST-O-WELD W-122 Blowpipe. Your present welding and heating work may not demand the limits of its outstanding performance. Still the reserve that's there—if and when you need it—is your continued assurance of steady, dependable operation and your safeguard against repair bills.

See for yourself the many additional features that put the PREST-O-WELD W-122 Blowpipe so far ahead of the field in economy, ease of operation, and low cost maintenance. Enjoy tomorrow's standards today. Ask your LINDE jobber for a demonstration. Or write to LINDE AIR PRODUCTS COMPANY, a Division of Union Carbide and Carbon Corporation, 30 E. 42nd Street, New York, N. Y.

* *"A flashback occurs when the flame disappears from the end of the tip and the gases burn within the torch or beyond the torch in the hose, usually with a shrill, hissing sound."*

—Definition from THE WELDING ENCYCLOPEDIA, *Thirteenth Edition.*

Get it from your

LINDE jobber

The terms "Linde" and "Prest-O-Weld" are registered trade-marks of Union Carbide and Carbon Corporation.

Inside Information proves

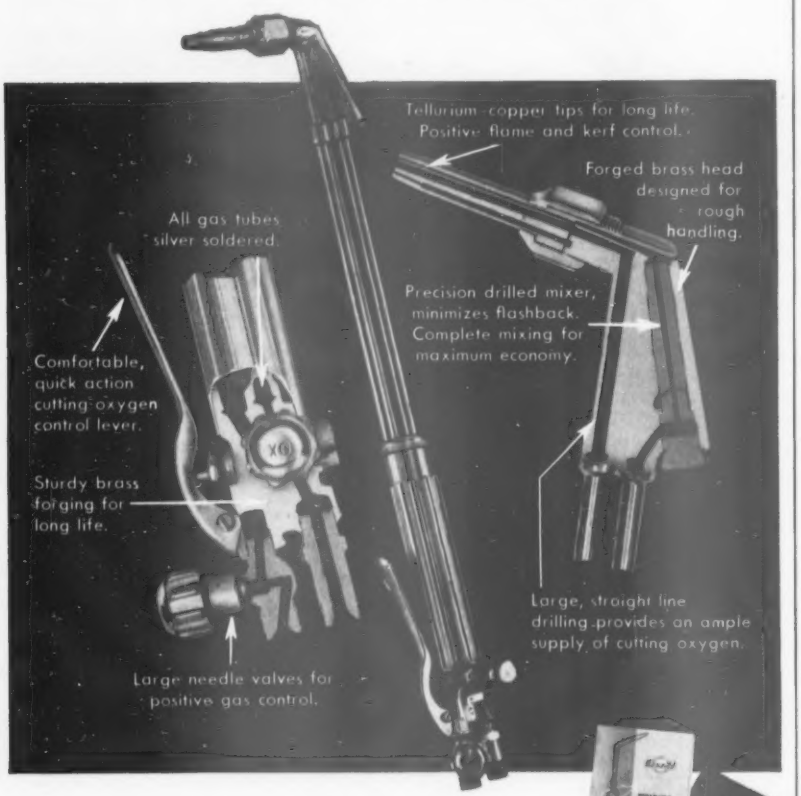
Gasweld

CUTTING TORCHES *are* BETTER-BUILT

The cutaway views show a few of the many fine features built into each piece of GASWELD equipment.

Featherlite or extra heavy duty — there's a GASWELD cutting or welding torch that will meet *your* needs perfectly.

Prove it to yourself — try a GASWELD torch today!


Tellurium copper tips for long life. Positive flame and kerf control.
Forged brass head designed for rough handling.
All gas tubes silver soldered.
Precision drilled mixer, minimizes flashback. Complete mixing for maximum economy.
Comfortable, quick action cutting oxygen control lever.
Sturdy brass forging for long life.
Large, straight line drilling provides an ample supply of cutting oxygen.
Large needle valves for positive gas control.

FREE CATALOGS

LIQUID manufactures a complete line of both gas and arc welding equipment and supplies. Send for your Gasweld and Arc Welding Catalogs today.

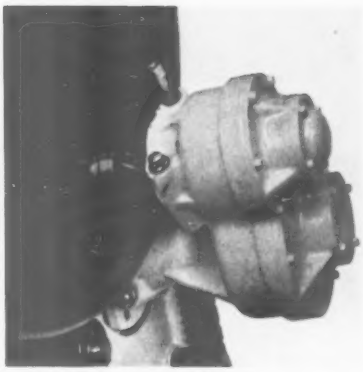
LIQUID also produces Oxygen, Acetylene and other commercial gases including CO_2 in all its forms — Gas, Liquid or Solid (Dry Ice) for industrial use.

INDUSTRIAL GAS DIVISION

Liquid THE **LIQUID** CARBONIC CORPORATION

3100 South Kedzie Ave. • Chicago 23, Illinois

West of the Rockies: STUART OXYGEN CO., LOS ANGELES • In Canada: IMPERIAL OXYGEN LTD., MONTREAL



Beveling attachment

INTERNAL beveling attachment on pipe saw makes possible welding of heavy-wall pipe directly to thin-wall pipe with one weld. This weld preparation eliminates use of a transition piece, and it permits greater distance between welds.

Cut and bevel are made in one operation as pictured above. The internal beveler reduces the thicker-walled pipe down to proper welding thickness for the thinner-walled pipe. This is said to result in a "machine-shop" bevel (inside and outside) ready for welding with no change in physical properties of the pipe.

THE E. H. WACHS CO., 1525 N. Dayton St., Chicago 22.

* * *

Flux dispenser

THIS firm's "Kwikflux No. 54" for silver brazing and hard soldering is now available in a new plastic squeeze dispenser, called the "Kwikfluxer." The container is made from pliable plastic, has a screw cap tip and can be refilled. Convenient to use, the dispenser eliminates need for brushes, jars, etc. User just pierces the tip, squeezes and applies to the work. Small opening eliminates waste from rapid evaporation and hardening.

SPECIAL CHEMICALS CORP., 100 S. Water St., Ossining, N. Y.

* * *

Stainless-steel wire

"CHROMAR" stainless-steel wire has been developed for welding chrome-nickel, straight chrome or chrome-molybdenum steels. The new wire is said to give sound welds with submerged-arc, inert-gas, oxyacetylene or atomic-hydrogen methods.

It is available in 17 different compositions in level-layer wound spools, coils and straightened and cut bundles. Standard coils have inside diameter of 12 in. and width of approximately 2½ in.

ARCOS CORP., 1500 S. 50th St., Philadelphia 43.

Spectacle side shields

DEEP-cup side protection is added to safety spectacles of any size or shape through use of new "Eye Savers Clip-On" side shields. Molded of clear or green acetate, they are easy to attach and remove, states manufacturer. If prescription glasses are worn outside the shop, the shields can be removed quickly at end of day and replaced each morning.

WATCHEMOKET OPTICAL CO., 232 W. Exchange St., Providence, R. I.

* * *

Aluminum solder

LIQUID-flux core of new aluminum solder, "AluTin 51," is said to have exceptional wetting properties. The solder has been developed for production, filling, sealing and repair operations upon wrought and cast aluminum alloys.

Melting range is between 400 and 500 F, and the alloy has a tensile strength up to 7,000 psi. Oxyacetylene torch, gas torch, furnace, induction or soldering iron may be used as heat source. Manufacturer states that low-melting point of this alloy makes it particularly suitable for soldering-iron applications.

EUTECTIC WELDING ALLOYS CORP., 40-40 172nd St., Flushing 58, N. Y.

* * *

Hardfacing electrodes

NEW series of general service iron-base, d-c hardfacing electrodes have metallic coating that is said to provide improved weldability and arc stability. Made of a chromium, boron and iron composition, the electrodes are available in two types: "Colmonoy No. 1" for hard-facing applications where extreme impact with high-abrasion resistance is required, and "Colmonoy Special No. 1" for applications where extreme abrasion and impact resistance are required. Both can be used where deposit must be welded on vertical surfaces.

Rockwell C hardness of the former is 58 to 63, the latter 60 to 65. Both are available in diameter sizes of 1/8, 3/16 and 1/4 in.

WALL COLMONOY CORP., 19345 John R St., Detroit 3.

You can get wear-resistant overlays with the hardness you want

Use AMPCO-TRODE* Electrodes and Filler Rod

Take your choice of ten deposit hardnesses

Get the right weld deposit hardness every time you make a wear-resistant overlay. Stock all five grades of Ampco-Trode electrodes and filler rod and you're ready for practically any job where metal-to-metal wear threatens you with downtime or production grief. Here's the Ampco-Trode lineup that assures the hardness you need.

Electrodes & Filler Rod	Deposit Hardness Metal-Carbon-Arc	Deposit Hardness Inert-Gas
Ampco-Trode 10	130-150	160-190
Ampco-Trode 160	150-170	190-220
Ampco-Trode 200	180-220	250-280
Ampco-Trode 250	230-270	310-340
Ampco-Trode 300	280-310	350-380

Here's something else! You can apply these hard bronze alloys by almost any process—whichever way meets your particular needs best—by metal-arc, carbon-arc, MIG, TIG, or submerged-arc. However you do it you get an overlay with remarkable life in severe metal-to-metal wear applications. It's ideal for adding extra life to bearings, bushings, sheaves, gears, pinions. It gives real stamina to sprockets, wear strips and plates, shafts, drawing and forming dies, and other tough applications. In some cases the service life of machine parts has been increased up to 5000% through use of Ampco-Trode facings.

You're money ahead — your machines last longer, perform better when you use wear-resistant Ampco overlays. Send the coupon for complete information today.

*Reg. U. S. Pat. Off.

AMPCO®

AMPCO METAL, INC.

Dept. WE-7 • Milwaukee 46, Wisconsin

West Coast Plant • Burbank, California

W-126

Free — Bulletin W-17 with complete information about welding with Ampco Bronzes. Send coupon for yours today.

Ampco Metal, Inc., Dept. WE-7, Milwaukee 46, Wis.

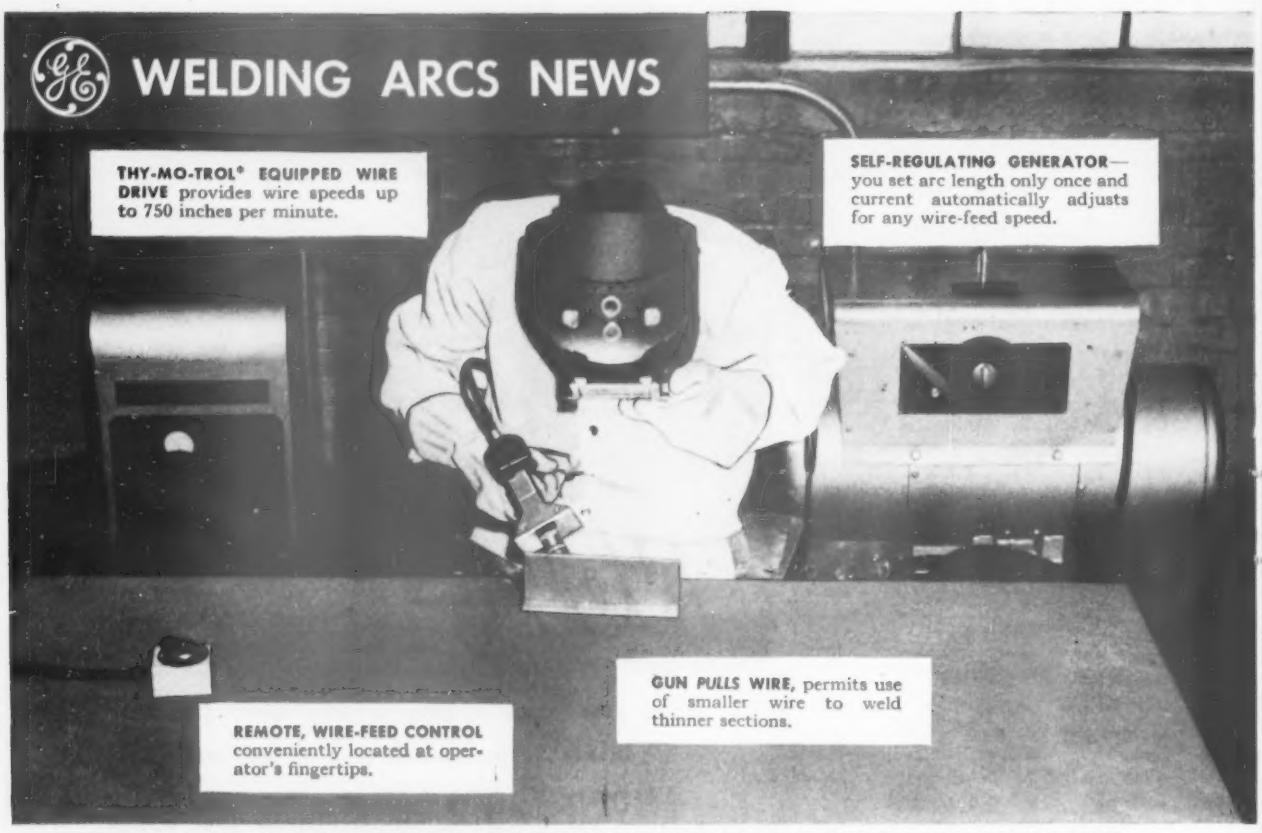
I'm interested in saving money with wear-resistant Ampco overlays. Send me bulletin W-17.

Name.....Title.....

Company Name.....

Company Address.....

City.....(.....) State.....


WELDING ARCS NEWS
THY-MO-TROL* EQUIPPED WIRE DRIVE provides wire speeds up to 750 inches per minute.
SELF-REGULATING GENERATOR—you set arc length only once and current automatically adjusts for any wire-feed speed.
GUN PULLS WIRE, permits use of smaller wire to weld thinner sections.
REMOTE, WIRE-FEED CONTROL conveniently located at operator's fingertips.

FILLERARC IS THE ONLY COMPLETE EQUIPMENT DESIGNED ESPECIALLY FOR CONSUMABLE-ELECTRODE GAS-SHIELDED WELDING

Now—demand for these Fillerarc* features permits G.E. to reduce price 15 percent

Production economies resulting from heavy customer demand, and use of expanded manufacturing facilities at General Electric's new plant at York, Pennsylvania now make possible a 15% reduction in the price of Fillerarc equipment.

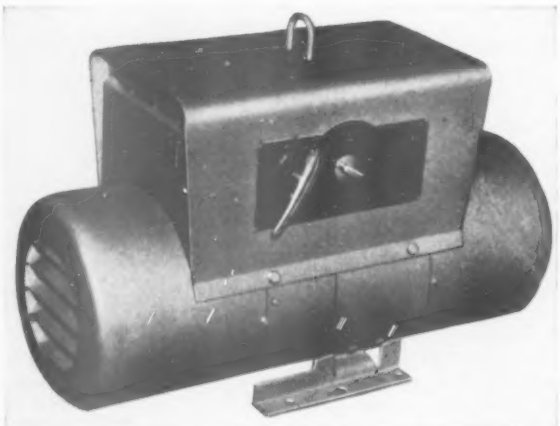
GENERATOR NOW AVAILABLE SEPARATELY

Also, you can now get the Fillerarc generator as a separate equipment. This self-regulating unit automatically supplies the right current to consume the amount of wire being fed. Once you set the arc length, current is correctly adjusted for every change in wire-feed speed.

CONTACT YOUR DISTRIBUTOR TODAY

Ask your nearest G-E welding distributor today for free bulletins on Fillerarc equipment. His name is listed on the opposite page and in the yellow pages of your phone book, under "Welding Equipment—General Electric." General Electric Co., Schenectady 5, N. Y.

*Registered trade-mark of General Electric Company.



G-E FILLERARC GENERATOR, now available as separate equipment, is the only generator with a rising volt-amp output characteristic. This minimizes burn-back, stubbing. For best performance with any consumable-electrode, gas-shielded equipment use this G-E power source.

TEST COMPARISON is made by Tractomotive Corp. employees between welds made with Strikeasy 1 and E-6012. Strikeasy 1 electrode welded 2 to 3½ times faster.

Tractomotive uses G-E Strikeasy 1 . . . increases welding speed 2 to 3½ times

General Electric powdered metal electrode is rapidly accepted by industry

Faster deposition rates . . . less operator fatigue . . . self-cleaning feature—these advantages of G.E.'s Strikeasy 1 contact electrode are being acclaimed by industry.

SAVE WITH STRIKEASY 1

The Tractomotive Corp. of Deerfield, Illinois has realized all these benefits of Strikeasy 1 in the welding of crawler tractor assemblies.

Says Tractomotive's general welding superintendent, S. E. Huffman, "Strikeasy 1 is that wonder electrode we've been needing for a long time. It's fast, practically self-cleaning and it produces a fine-quality weld. That means money saved, a boost in production, and a better all-round job."

USE FOR HIGH-SPEED JOBS

Strikeasy 1 conforms to AWS specifications for E-6012 electrodes in the flat and horizontal position.

Use Strikeasy 1 for those applications where the important factor is higher production speed. With this powdered-metal electrode, Tractomotive operators produced 21 inches of ⅜-inch fillet weld in 1½ minutes. The conventional E-6012 electrode filled the same length weld in 7½ minutes.

TEST STRIKEASY 1 ON YOUR JOB

Try Strikeasy 1 on any job where you are now using E-6012. See how it can speed up production and still produce the quality of weld you need.

For detailed information on this new standard in high-speed electrodes, see your nearest G-E welding distributor. His name and address are listed at the right.

710-18

G-E WELDING DISTRIBUTORS

Alabama: Birmingham—Alabama Oxygen, Young & Vann Supply; Mobile—Turner Supply

Arizona: Phoenix—Consolidated Welding Supply

California: Fresno, Los Angeles, Oakland, Sacramento, San Diego, San Francisco, Ventura—Victor Equipment

Colorado: Boulder, Colorado Springs, Denver, Durango, Ft. Collins, Ft. Morgan, Greeley, LaJunta, Longmont, Pueblo, Sterling—Hendrie & Bolthoff

Connecticut: Hartford, New Haven—Harris Company

Florida: Hollywood—Florida Gas & Chemical

Georgia: Atlanta, Macon—Welding Supply & Service; Augusta—Marks Oxygen; Columbus—Williams Welding Supplies

Idaho: Boise—Olson Manufacturing

Illinois: Chicago, Moline, Morton, Rockford—Machinery & Welder

Indiana: Evansville—Drillmaster Supply; Ft. Wayne, Indianapolis—Sutton-Garten; South Bend—Perry Welding Sales & Service

Iowa: Des Moines—Machinery & Welder

Kansas: Wichita—Standard Products

Kentucky: Louisville—Reliable Welding; Paducah—Henry A. Petter Supply

Louisiana: Alexandria, Shreveport—Hughes Oxygen; New Orleans—Consolidated Welding Supplies

Maryland: Baltimore—Arcway Equipment

Massachusetts: Boston—New England G-E Welding Sales Division

Michigan: Detroit—Welding Sales & Engineering; Grand Rapids—Miller Welding Supply

Minnesota: Duluth—W.P.&R.S. Mars; St. Paul—Production Materials

Mississippi: Jackson—Jackson Welding & Supply

Missouri: Kansas City—Hohenschild Welders Supply; St. Louis—Machinery & Welder

Montana: Billings—Valley Welders Supply; Billings, Bozeman, Cut Bank, Glasgow, Great Falls, Havre, Kalispell, Miles City, Shelby, Sidney, Whitefish—Valley Motor Supply; Butte, Great Falls—Montana Hardware

Nebraska: Lincoln—Lincoln Welding & Supply; Omaha—Baum Iron

New Jersey: Kenilworth—Weldir ; Sales Corp.

New Mexico: Albuquerque—Industrial Supply Co.; Hobbs—Western Oxygen; Las Cruces, Silver City—Car Parts Depot, Inc.

New York: Buffalo—Welding Equipment Sales; New York—Welding Sales Corp.; Syracuse—Welding Engineering & Equip.

North Carolina: Charlotte—Dixie Gases; Gastonia—Gastonia Motor Parts

North Dakota: Bismarck, Fargo—Acme Welding Supply

Ohio: Akron, Cincinnati; Cleveland, Columbus, Dayton, Mansfield—Burdett Oxygen; Toledo—Odland Iron Works

Oklahoma: Oklahoma City—Hooper Supply

Oregon: Eugene, Portland—J. E. Haseltine; Medford, Portland—Industrial Air Products

Pennsylvania: Allentown, Philadelphia, Pittsburgh—Arcway Equipment

South Carolina: Columbia, Greenville—Welding Gas Products

South Dakota: Deadwood—Hendrie & Bolthoff

Tennessee: Chattanooga, Knoxville, Nashville—Welding Gas Products; Memphis—Delta Oxygen

Texas: Abilene—M&M Welding Supply; Alice, Corpus Christi—Crane Welding Supply; Alpine, El Paso, Marfa, Pecos—Car Parts Depot; Amarillo—Welding Equipment & Supply; Beaumont—H. & W. Welding Supply; Brownsville, Harlingen—Acetylene Oxygen; Dallas—Hill Equipment & Supply; Houston—G-E Welding Sales Division; Lubbock—Welders Supply of Lubbock; Midland—West Texas Welders Supply; Odessa, Pecos—Western Oxygen; Orange—Marine & Petroleum Supply; Pecos—Welding Supply Co.; Plainview—Plains Welding Supply; San Angelo—Southwestern Welding Supply; Texarkana—Hughes Oxygen; Wichita Falls—Nortex Welding Supply

Utah: Salt Lake City—The Gallgher Co.

Washington: Seattle, Spokane—J. E. Haseltine; Spokane, Yakima—Industrial Air Products

West Virginia: Bluefield—Bluefield Supply; Charleston—Virginian Electric; Huntington, Logan—Logan Hardware & Supply

Wisconsin: Milwaukee—Machinery & Welder

Alaska: Anchorage—Northern Supply

Canada: Toronto—Canadian G.E.

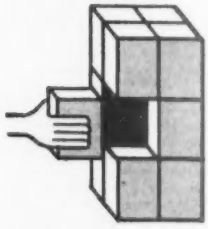
Hawaii: Honolulu—American Factors, Ltd.

GENERAL ELECTRIC

WHAT'S NEW IN WELDER DESIGN?

UNITIZED CONSTRUCTION, IMPROVED DESIGN of Federal's Rocker-Arm Spot Welder MEANS BETTER WELDS, FASTER, LOWER UPKEEP

UNITIZED DESIGN
A Federal Exclusive!



Component parts of each system are sectionized and mounted on individual, removable panels. Normal "down-time" is reduced to an absolute minimum; maintenance greatly simplified.

Federal's New Rocker Arm Spot Welders—redesigned from base to tip—to deliver highest production with a minimum of operating and maintenance costs. Feature for feature they are the outstanding low cost spot welders of this type available today.

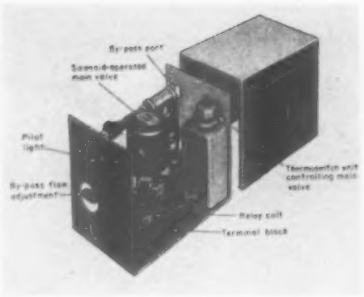
Here's a few of the many features: Unitized Design, built in sections for easy maintenance and interchangeability; More Space, tapered frame permits greater working areas; Compact Construction, trims bulk—all lines are outside frame—easily accessible without unsightly and dangerous protrusions; Ferrule Fittings, with threaded couplings, permit quick, simple disconnect of all water and air connections; Low Loss Cylinder of new design boosts efficiency as does the new style Low Inertia, streamlined Horn Raising Lever. It's all new! It's welding efficiency at it's finest. It's another reason why welding engineers trust "Federal—First in Resistance Welding."

THE FEDERAL MACHINE AND WELDER COMPANY

WARREN, OHIO

Federal® WELDERS

Warco® PRESSES



Automatic valve

FOR use in resistance welding as well as in other operations, this automatic valve is said to assure cooling water when needed and shuts itself off after equipment has safely cooled.

When used with welding equipment, an air solenoid valve coil or clutch solenoid on the welder opens the valve in the "Water Mizer" through a relay. As long as the operation continues, the solenoid holds the valve open, providing a full flow of water to the equipment. A return line carries water back to the "Mizer" where the flow is monitored by a "Thermoswitch" unit before going to drain. A pilot light indicates when water is flowing through the valve.

The thermostatic shut-off is manufactured by Fenwal, Inc., Ashland, Mass.

VAN VOOREN PRODUCTS, East Moline, Ill.

* * *

Four-purpose electrode

"CHAM-CUT" is name of new electrode designed for electric-arc cutting, chamfering, gouging and piercing. Flux coated with a special alloy, it is said to have fast cutting rate and to be highly effective for work on all types of steels, cast iron and copper and nickel alloys.

It can be used with a-c, d-c, reverse or straight polarity. "Cham-Cut" is available in diameter sizes of 1/8, 5/32, 3/16 and 1/4 in. It's packaged in 10-lb metal containers.

PACIFIC WELDING ALLOYS CO., INC., 312 N. Avenue 21, Los Angeles 31.

* * *

Fluorescent penetrant

NEW scale of sensitivity in penetrant inspection is said to be available in new fluorescent inspection material, called "Zyglo-Pentrex." Manufacturer states it has its greatest advantage over previous penetrant inspection methods in finding both very tight cracks and broad, shallow defects.

MAGNAFLUX CORP., 7300 W. Lawrence Ave., Chicago 31.

Inert-gas equipment

VACUUM-type, high-frequency source for use in inert-gas welding operates with any torch and welder combination. It is said to provide improved cleaning action and closer control of the weld for smoother joints.

The "Gas Saver" is available in combination with the high-frequency unit or separately. It is said to effect savings on argon or helium consumptions by as much as 50%. Timer controls gas flow and protects hot electrode from oxidation, thus increasing tungsten life. Single dial permits variable control. Both units, standard, are powered by 110 volts, a-c, 60 cycles. Other voltages and frequencies available.

ELECTRON-ARC, INC., 210 Broad St., Lynn, Mass.

* * *

Welding generator

Now available as a separate power source is the "Fillerarc" generator for consumable-electrode, gas-shielded welding. Heretofore the generator had been offered only as an integral part of the "Fillerarc" apparatus, which also includes a welding gun and wire drive unit.

Rated at 450 amp continuously, the generator is designed to maintain a constant arc length. The unit has a rising volt-ampere characteristic and is self-regulating. Once arc length is set, operator can change wire feed even while welding, without adjusting the welder. Wire feeding speeds up to 750 ipm can be accommodated.

GENERAL ELECTRIC CO., Welding Dept., York, Pa.

* * *

Electrode

COMPLETE line of 15 different stainless-steel welding electrodes is designed for use with either a-c or d-c. Each in the line is said to give a fast rate of deposit, reduce spatter loss to an absolute minimum, create a very soft arc and facilitate an easy slag removal.

Stainless-steel base wire is of uniform quality, manufacturer states, and the heavy coating of special flux is designed to prevent oxidation of weld metal and maintain same physical properties and chemical analysis as parent metal.

PACIFIC WELDING ALLOY MFG. CO., 310 North Avenue 21, Los Angeles 31.

* * *

HUMAN *history becomes more and more a race between education and catastrophe.*
—H. G. Wells

Get better welds —at lower cost with

Bridgeport No. 192 Low Fuming Bronze Rod

Braze welding proved best in fabricating this deflector arm for a separator table. The steel swivel arm and the brass deflector plate were joined solidly in a matter of minutes with Bridgeport No. 192 Low Fuming Bronze Rod. Time and again, braze welding has proved to be the most economical method of repairing iron and bronze castings; building-up worn surfaces on gears, shafts or housings, as well as for production operations.

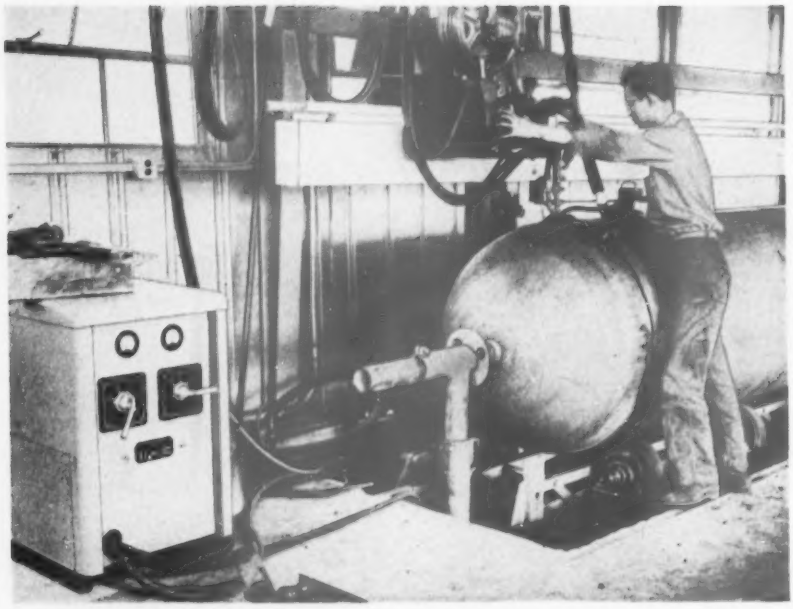
With only local preheating needed, large repair jobs can be done on the spot, without dismantling heavy equipment. What's more, braze-welded repairs are often stronger, less brittle than the original casting.

For your brazing requirements, Bridgeport No. 192 is a low fuming manganese-type rod recommended for all-purpose welding. Read the complete story in Bridgeport's booklet, "Bronze Welding Alloys." Write for your copy today.

BRIDGEPORT BRASS COMPANY ◆ BRIDGEPORT, CONNECTICUT

Mills at Bridgeport, Conn., and Indianapolis, Ind.
In Canada: Noranda Copper and Brass Limited, Montreal

BRASS • BRONZE • COPPER • DURONZE • SHEET • ROD • WIRE • TUBE



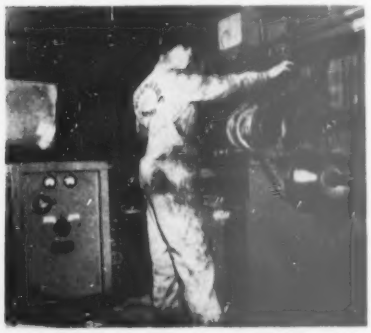
Roundabout weld on L.P. gas tank head with GLENN CV Welder and submerged arc process. A second GLENN unit powers automatic seam welding in this modern tank plant.

Automatic Welding with GLENN Constant Voltage Welders Reduces Control Problems, Produces Uniformly High Quality Welds at Lower Cost

HOW THEY WORK

GLENN CV Welders deliver a fixed, pre-settable arc voltage that stays constant throughout the welding cycle . . . with no appreciable change even when tack welds or areas of poor fit-up are encountered.

No external voltage controls are needed. Current (amperage) is determined by rate of rod feed. Operation is simplicity itself; the welder merely presets the desired arc voltage, sets the correct feed rate on the feed roll motor, and starts the machine. Arc ignition and recovery are instantaneous; deposit and penetration stay steadily uniform because arc voltage and wire feed stay constant.



Smoother, more uniform hard facing deposits result from GLENN CV Welder's fixed arc voltage.

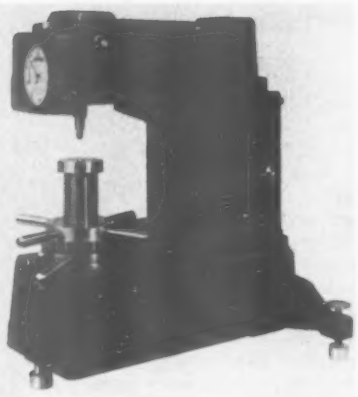
COMPLETE LINE

GLENN CV Welders are available in 3 models with continuous-duty ratings of 500, 750 and 1200 amperes, 18-42 volt arc voltages. They operate from 3-phase a.c. power supplies in all common line voltages. Efficiency is 85% or better, power factor 90% or better, at all settings. For comparable capacity, they cost less to install, operate and maintain . . . and help you produce more and better welding.

JOB PROVED

GLENN CV Welders are the original —and only—constant voltage power sources job-proved for more than a year on submerged arc, inert gas, "squirt" and automatic stud welding. They've licked tough control problems on 3 o'clock and field welding jobs, on pipe mills, roundabout and long seam welds. They've simplified welding on aluminum, copper, stainless, mild and alloy steels.

Get the facts now. Write **GLENN COMPANY**, 3134 East 10th Street, Oakland 1, California, or 10222 Avenue N, Chicago 17, Illinois.



Hardness tester

BOTH regular and superficial Rockwell hardness tests can be made with new "Kentrall" hardness tester. In its dual function, the apparatus makes all regular Rockwell tests (60, 100 and 150 kg loads) and superficial tests (15, 30 and 45 kg loads) with any suitable standard C, N or ball type indenter. All results show on a dial gage with a single numerical scale.

Minor and major loads are applied by dead weights, not springs.

Standard equipment supplied with each tester includes all weights for regular and superficial testing, 1/16-in. diameter steel ball indenter, four anvils and eight test blocks.

THE TORSION BALANCE CO., Clifton, N. J.

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"ELECTROPAK" is new container for electrodes that is said to provide excellent protection against weather damage and rough handling. It is opened by stripping the tape and lifting metal lid; no cutting or breaking open is required. Recessed rim provides tight closure against moisture and spilling. Sheet of aluminum foil between outer and inner walls prevents moisture pickup.

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—THE AIRCO H12A

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$58.30

This brand-new Airco Heliweld holder gives you quality welds in thin-gauge aluminum, stainless steel, magnesium and copper alloys with ease and convenience . . . and at a highly attractive price. The H12A combines light weight with water cooling. Weighs only four ounces and is 7½ inches long. Continuous duty rating of 125 amps AC or DC. It's the perfect answer to fatiguing long-run jobs, and to making welds in tight corners, where the water cooling keeps it from overheating. Like other Airco manual Heliweld holders, the H12A has gastight "O"-ring seals in the nozzle and cap assembly and takes a full selection of collets and ceramic nozzles . . . no arc-shorting in confined areas!

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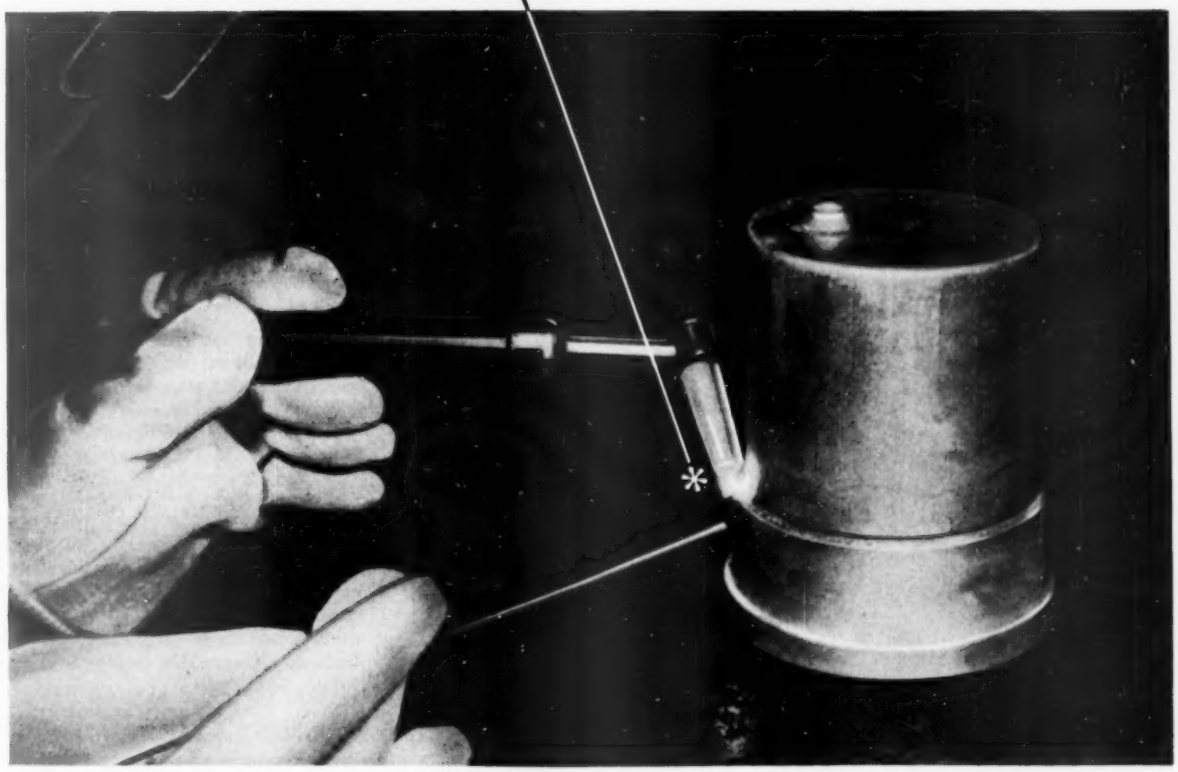
For complete information on this and other Airco Heliweld equipment, see your Airco dealer, or write for Catalog 2300, "Airco Heliwelding Equipment."



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Small, pocket-size instrument, "Bennett Gas Volume Meter," will continuously indicate volume readings of any gas passed through it. J. J. MONAGHAN CO., INC., 500 Alcott St., Denver 4.

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FINANCIAL AID TO HIGHER EDUCATION

Our Colleges and Universities Face Grave Financial Problems

For the past decade the nation's colleges and universities have been caught in a destructive financial squeeze. It is particularly destructive for the independent, privately endowed institutions. Unless extraordinary measures are taken to relieve this squeeze, it promises to become progressively worse. To let it do that is to court a national disaster.

This is the first of two editorials devoted to the financial plight of our colleges and universities. This first editorial deals with the character of the problem, present and potential. The second will indicate some things that need to be done about it, and particularly what American business might do.

Enrollment Soars, Income Lags

In broad outline, the financial problem that afflicts our colleges and universities is simple. The demand for their services has increased rapidly, and promises to keep on increasing even more rapidly. At the same time, their financial capacity to provide these services has lagged behind, primarily because of price inflation.

Between 1940 and 1950, college and university enrollment increased from approximately 1⅓ million to 2⅓ million—about 75 per cent. Over the same period, the educational income of these institutions, measured in terms of its actual purchasing power, increased only about 64 per cent. Thus, at the end of the decade, our colleges and universities as a group had, on the average, about 6 per cent less to spend per student than they had at the beginning. Meanwhile, the rapid advance of science and technology had made a good college or university course a much more expensive operation than it was in 1940. Since 1950, the latest date for which comprehensive figures are available, the financial squeeze on our colleges and universities has intensified, largely because of another wave of price inflation touched off by the Korean War.

Among the colleges and universities, the independent, privately endowed institutions are particularly hard pressed. In terms of actual purchasing power, the independent liberal arts colleges are now spending at least 20 per cent less per student than they spent in 1940. Public institutions of higher learning, supported out of tax revenues, have managed to increase slightly their expenditure per student. Otherwise, the financial squeeze on higher education as a whole would be even more severe.

Why Independent Colleges Are Hit Hardest

The principal reason why the independent colleges and universities are so hard up is the shrinkage in their income from endowments. These endowments, created in other days by gifts of generous benefactors to help pay the expenses of higher education, have been hit hard from two directions. During the war and post-war years, the tax collector took so large a part of the incomes and estates of wealthy people that this source of endowments has been greatly reduced. Over the same period price inflation cut in half the purchasing power of the income derived from existing endowments. In 1940 income from endowments provided 26 per cent of the total income of the independent colleges and universities. By 1950 it provided only 14 per cent. The figure is still lower today.

The financial plight of the independent colleges and universities is directly reflected in the salary status of their teaching staffs. In mid-1952 a national survey showed that, after adjustment for the increased cost of living, the salaries of those holding full professorial rank in these institutions were 12 per cent lower than they were in 1941-42. Junior teachers, with the rank of instructor, fared somewhat better. In terms of actual purchasing power, their salaries declined only 2 per cent over the 12-year period, largely because there is more direct competition for their services from industry. Over the same period, the real wages of industrial workers increased 55 per cent.

Time Will Not Provide a Cure

The plight of the colleges and universities, which is shared in some degree by all parts of our educational system, is not one that can be left to time for a cure. On the contrary, the financial problems of our institutions of higher learning will be intensified in the years ahead by the pressure of rapidly increasing enrollments. Present prospects indicate that during the next decade college and university enrollment will increase by about one-third, or from 2⅓ million to over 3 million. The problem of increased enrollments will become particularly acute toward the end of this decade when the babies born during the great surge of population in World War II are ready to enter college.

Such an increase in population as that now in prospect can be a tremendous asset to the nation. It is still a truth, even though it is worn a bit thin by frequent repetition at commencement exercises, that a nation has no resource more valuable than the education of its people. And the better the education, the more valuable the asset.

But to realize this, our colleges and universities must have the financial strength to handle the increased enrollments that face them in the years ahead. This means that we must relieve our independent colleges and universities, in particular, from the financial squeeze in which they are now caught and make them full partners in the economic well-being of the nation. Some of the means by which American business might help achieve this will be discussed in a second editorial.

This message is one of a series prepared by the McGraw-Hill Department of Economics to help increase public knowledge and understanding of important nationwide developments that are of particular concern to the business and professional community served by our industrial and technical publications.

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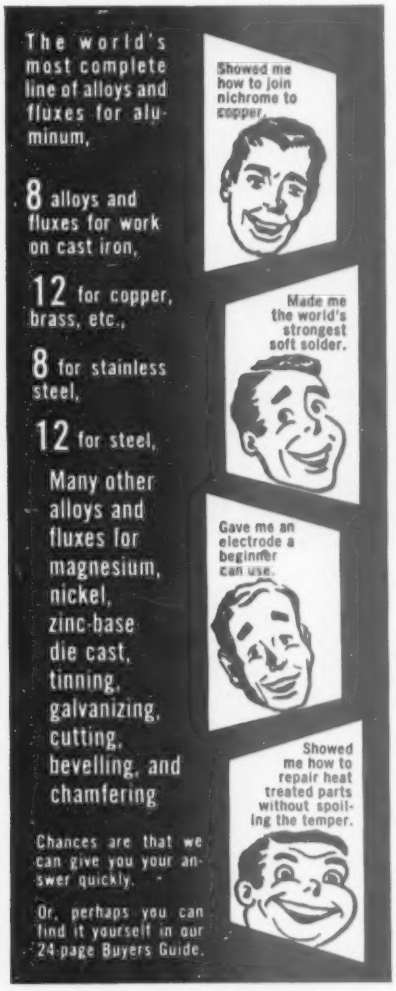
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Improved Rockwell-hardness testing machine, "Model HT-1," can perform 400 high-precision tests per hour, according to manufacturer. GRIES INDUSTRIES, INC., Testing Machines Div., New Rochelle, N. Y.

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Designed particularly for precision temperature measurements in the laboratory, a new optical pyrometer is still sufficiently portable to be used for general plant applications. PYROMETER INSTRUMENT CO., Bergenfield, N. J.

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Rubber-cushioned abrasives compounded with silicon carbide come in grain sizes ranging from extra coarse to extra fine. WELDON ROBERTS RUBBER CO., Brightboy Industrial Div., 6th Ave. and North 13th St., Newark 7, N. J.

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Midget thermostat may be used (with suitable relay circuit) as precision temperature controller in any heated device or as an overheat detector wherever overheating might endanger a process or mechanism. FENWAL INC., Ashland, Mass.

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Fatigue tests under loads up to 50,000 lb on a 10,000-lb capacity fatigue machine are provided by new "Sonntag Five-to-One" multiplying fixture. Accessory is especially suited for testing flat metals and plastics. BALDWIN - LIMA - HAMILTON CORP., Philadelphia 42.

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Adjustable rubber knee pads offer soft sponge rubber protection for every kneeling job. Non-slip waffle tread grips wet or slippery surfaces. GENERAL SCIENTIFIC EQUIPMENT CO. 2700 W. Huntingdon St., Philadelphia 32, Pa.

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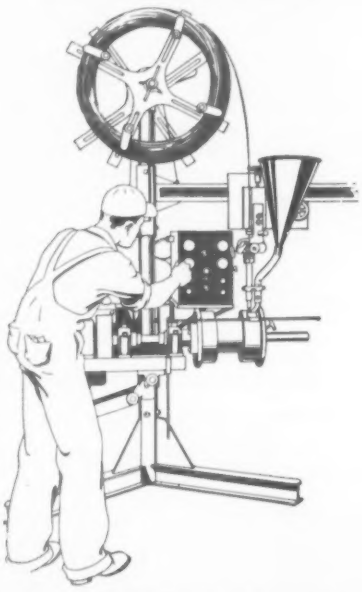

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MESSAGE for MANAGEMENT

Call on the AWS Member in your employ - - -

He has new ideas about REPAIR, REMODELING and PRODUCT IMPROVEMENT through the use of welding.

If there is an engineer or welder in your shop, he undoubtedly has some ideas about the use of weldments for materials handling, storage fixtures and shop maintenance. If he is a member of the American Welding Society, his practical knowledge of welding is fortified with technical and engineering information gathered from AWS publications and regular monthly meetings with other members of the society.

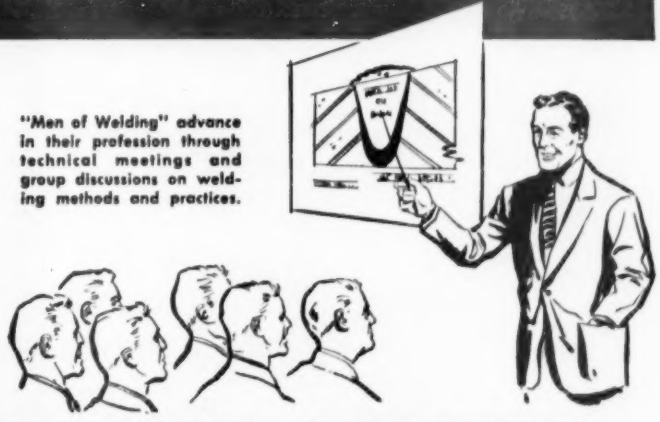
There are a great many plant executives, engineers and welding operators who devote their own time and money to increase their knowledge of welding methods and weldment design. These men deserve your encouragement.

If the "Men of Welding" in your organization do not participate in AWS activity, we suggest that you urge them to do so. Your firm will profit from their new viewpoint, their aroused interest and their increased knowledge of welding.

A. W. S. Builds "MEN OF WELDING"

There are 66 active local sections of A.W.S. covering the entire United States. The 9,683 members of A.W.S. hold monthly technical meetings and plant visitations where they observe practical solutions to typical welding problems and study new welding methods. They receive accurate information on welding design, fabrication and maintenance through discussions with the best welding minds in the nation and authoritative printed reports.

"Men of Welding" advance in their profession through technical meetings and group discussions on welding methods and practices.



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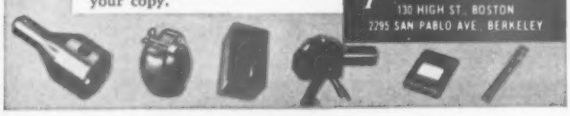

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Letters should be addressed to: The Editor, WELDING ENGINEER, 520 N. Michigan Ave., Chicago 11, Ill. No letter will be published unless signed, but your name will be withheld if you request it.

Continuous welded rail

Dear Sir:

Regarding any inquiries you've received pertaining to expansion of long welded rail ("Half-mile welded rails ride 850 miles," WELDING ENGINEER, January): to understand "endless" or continuous welded rail, it is only necessary to understand a couple of simple things.

First: steel has an elastic limit. When any force less than the elastic strength is applied and removed, the metal will return to its former shape and size. This is true in bending and pulling and pushing. Just as a leaf spring can be bent and will spring back or a coil spring can be stretched or compressed and will spring back to its former shape, so will a bar of steel do the same. It is even possible to calculate the force needed to cause the change in length. This is what is marked on the dial of the ordinary spring scale. For a straight steel bar, it is calculated by this formula: E = Stress/Strain. For steel, E is about 30,000,000.

Second: when metal is heated, three things happen. The temperature changes, length changes or pressure changes or both. Pressure ordinarily is forgotten because it is usually only atmospheric pressure. When a rail is well spiked on a properly ballasted roadbed, it is like a heavy coil spring in the jaws of a vise. If the coil spring is heated, it will push harder against the jaws of the vise in trying to become longer. A straight bar of steel in vise jaws would do the same. Each short piece of rail acts on each side of the rail just as the bar of steel acts on the jaws of the vise. Suppose the rail is laid when the temperature is 60 F. When the sun beats down on it on a hot day, its temperature might go up to 160 F. This hike of 100 deg would cause a 1-in. length of rail to expand:

100 F × .0000065 in./F = 0.00065 in., change in length.

It is now possible to calculate the force which would be needed to push the steel back to the length it originally had and which it would not be able to change if it were part of the rail. The change in length just calculated is used as "strain" in the above equation.

30,000,000 = Stress/0.00065.

30,000,000 × 0.00065 = Stress = 19,500 psi, the stress due to change in temperature.

On a day when the temperature is —40 F, there is again a change of 100 deg. This time the rail is pulling instead of pushing. By the same calculations just made, the stress is found to be the same but of opposite sign.

It is always true that a rail is under stress when a train passes over it. This stress may be added to that due to temperature or may be of opposite sign and reduce the final stress. Stress caused by the usual equipment now in use is about 13,000 psi. When these two stresses are combined:

19,500 psi + 13,000 psi = 32,500 psi, or

19,500 psi — 13,000 = 6,500 psi

The larger stress should be examined to see whether it is dangerous. Rail steel with a tensile strength of 135,000 psi will have a yield strength of about half that, or 65,000 psi.

32,500/65,000 = ½

This means that only about half of the elastic strength of the steel has been used. When the combined load of train and temperature is removed from the rail, it will return to its original size and shape. Either hot or cold, there will be no plastic set or permanent change in size or length of the rail. All conditions have been taken care of by the springy nature of the steel.

Yours truly,
Prof. Charles E. Martin
Purdue University
West Lafayette, Ind.

* * *

More on April editorial

Dear Sir:

I certainly enjoyed your letter in the April issue of WELDING ENGINEER, and I hope that a lot of people will read it as it is full of merit. As you state, a 25% margin of profit is necessary for the distributor. Actually, this is just the break-even point. I don't know if you have the figures or not, but the National Welding Supply Association has published individual and composite operating figures, and for the years 1950, 1951 and 1952.

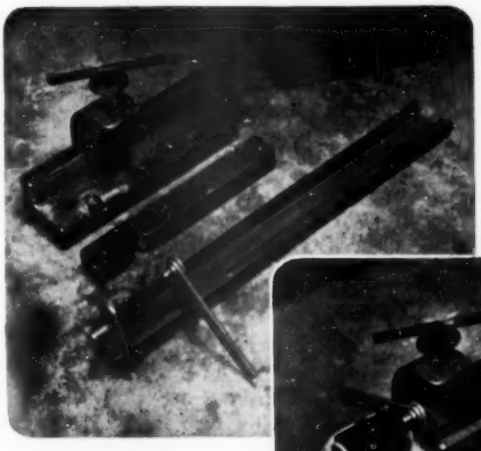
The average operating expense for all distributors reporting throughout the country amounts to 25% or

BRAZE HARDENED PARTS SAFELY...with EASY-FLO

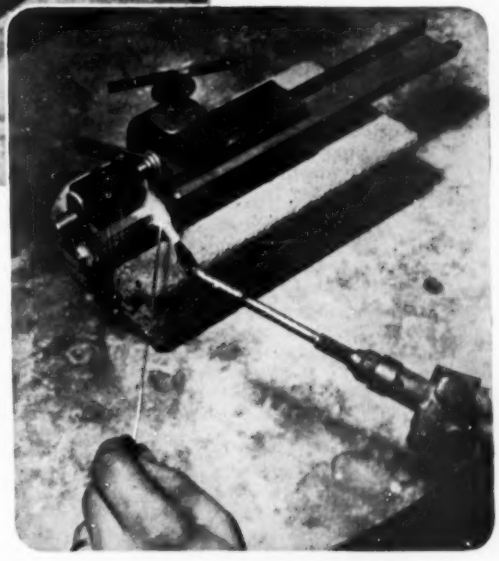
With EASY-FLO — the low-temperature silver brazing alloy — you can braze parts that have been hardened, without appreciably affecting their hardness. That's because EASY-FLO's low brazing temperature, plus its remarkably fast penetration the instant this temperature is reached, greatly reduce the amount of heat and the heating time required.

By using copper bars as "chill bars" to help dissipate the heat, you can make doubly sure of preserving the hardness of the parts.

HERE'S AN EXAMPLE—a hardened steel part of a ticket vending machine, brazed for the General Register Corp. by Salkover Metal Processing of New York, Inc., Long Island City, N.Y., metal joining specialists.



At left is a hardened steel machine part and the two brackets that are brazed to it; also two copper chill bars, one of which has a clamp screw.



At right you see the hardened assembly clamped between the two chill bars and the arm bracket being brazed to it with 3/64" EASY-FLO wire. Clamping assures the close contact needed for good conduction of heat to the chill bars. Both brackets are brazed with no appreciable change in the hardened surfaces.

FIND OUT WHAT EASY-FLO BRAZING WILL DO FOR YOU

BULLETIN 20 gives full details about the remarkable metal joining strength, speed and economy manufacturers everywhere are getting with EASY-FLO low-temperature silver alloy brazing. Write for a copy today.

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to be absolutely sure
make certain you use . . .

ARCALOY

STAINLESS STEEL ELECTRODES

- ***Controlled*** **high quality**
- ***Properly*** **formulated coatings**
- ***Uniform*** **welding characteristics**
- ***Analyses*** **for all A.I.S.I. stainless steel grades**
- ***Packaged*** **in hermetically sealed metal containers**

Alloy Rods Company's *one job* is to make the finest electrodes. This specialization permits the highest standards of quality control throughout the entire production cycle—from the proper analysis of the core wire and the application of the correct coating to the finished electrode.

ARCALOY'S superior coatings produce a slag that is easily and completely removed and that saves expensive labor time. But most important of all, ARCALOY electrodes are *reliable*. The closely controlled quality supervision under which they are produced will give you top-flight, uniformly excellent welding, month after month.

ARCALOY Stainless Steel Electrodes are available for all grades of chrome-nickel and straight chrome stainless steels with either AC-DC coating or lime coating. Your Alloy Rods distributor will supply the right electrodes for your corrosion and heat resisting services . . . send your order today.

OVEN FRESH! ARCALOY Electrodes are packaged in the familiar ALLOY RODS red-and-yellow hermetically sealed metal containers. Available in 1/16", 5/64", 3/32", 5/32", 3/16" and 1/4" diameters.

Alloy Rods Co.

General Offices and Plant • York 3, Pennsylvania
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ARCALOY Stainless Steel Electrodes • BRONZE-ARC Phosphor Bronze Electrodes • NICKEL-ARC Electrodes for Cast Iron • TOOL-ARC Electrodes for Tools and Dies • WEAR-ARC Hard-Facing Electrodes WELD-ARC Low Hydrogen Electrodes

no finer electrodes made . . . anywhere

more; therefore, the 25% margin would actually result in a small operating loss. The figures for 1953 will be out shortly, and I will be surprised if they are not somewhat higher.

Another point that should be made is that as your dollar volume of sales goes up, your operating expenses also go up, which would mean that when you cut prices, you not only have to increase your volume proportionately to take care of the price cut, but you have to increase it further to take care of the additional overhead expenses to handle this additional volume of sales.

Some people erroneously believe that after they reach a certain sales point, they won't incur any more operating expenses, but all they have to do is examine their books for a sad awakening. Of course, it may not always be in the same proportion, but it is always more than one would anticipate.

Sincerely yours,
Paul E. Haygood
Louisiana Welding Supply Co.
Baton Rouge 2, La.

* * *

"Grass roots"

Dear Sir:

In WELDING ENGINEER of February, we have read with much interest the article "Grass roots of stress control." Issuing a neutral house magazine with 6,000 monthly copies, we should much appreciate to have your allowance to reprint this article, of course with full acknowledgment.

Thanking you in anticipation for a favorable reply, we remain,

Yours truly,
F. Loos, Dir.
G. L. Loos & Co.'s
Fabrieken N. V.
Amsterdam
The Netherlands

You have our permission to reprint the article, which was authored by Joseph Holt.

"I DON'T CARE IF THE LIGHT IS POOR FOR READING!"

NEWS . . . . . *from page 6*

Janeiro, Brazil, undertaken to harness and utilize water power from rivers and reservoirs in the mountainous region 40 miles from Rio de Janeiro, to produce more electricity for the Brazilian capital.

A tunnel 25 ft in diameter was blasted through solid rock to direct the flow of water, at a 45-deg angle, to a huge underground power plant constructed in a rock cavern, widened to about the size of a football field.

The half-hour program tells how the A. O. Smith Corp., Milwaukee, designed, fabricated and supervised field welding of a tubular steel penstock, used to line the inside of the tunnel. The "pipe," 21 ft in diameter, 1,600 ft long and weighing about 3,500 tons, was designed to withstand the enormous force of water plunging down to the power plant.

The film concerns itself principally with engineering problems involved and methods devised for assembling and welding the pipe sections, and for erecting them in the tunnel. Fabrication of the penstock was done in the A. O. Smith plants in Milwaukee and Houston.

The firm sent a crew of experts to Rio to supervise the complicated welding of the penstock sections and the metallurgical treatment and testing.

Prior to the showing of the film, L. B. Smith, president of A. O. Smith, is interviewed by the "Better Living Television Theater" moderator, Fischer Black, editor of *Electrical World*, a McGraw-Hill publication.

* * *

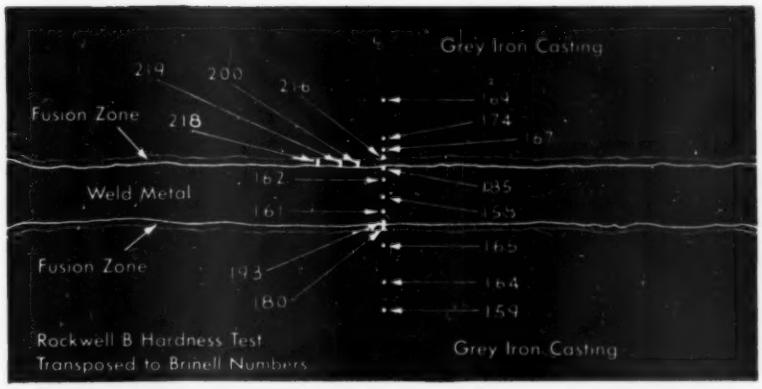
Philips opens X-ray office in Chicago

OPENING of a new regional office at 4959 W. Diversey Ave., Chicago, was recently announced by the Research & Control Instruments Division, North American Philips Co., Inc., Mount Vernon, N. Y. John C. Washburn is manager of the new industrial X-ray headquarters which serves an area including Illinois, Iowa and Missouri and portions of Indiana, Kansas and Nebraska. Assisting him is Robert L. Smick.

* * *

Milwaukee distributor holds open house

MORE than 300 persons attended the open house recently held by Norton, Inc., Milwaukee welding supplies and equipment distributor. The firm, founded in 1946, recently moved to a new building at 3876 N. Port Washington Ave.



This drawing shows an actual test made on a machined casting welded with Nickel-Arc. Notice that the fusion zone of the weld is less disturbed or affected by the heat of welding and remains well within the machinable range. Notice also that the weld metal has a hardness that matches that of the base metal.

Better Machinability of Cast Iron with NICKEL-ARC

. . . and here's proof!

Nickel-Arc's special coating keeps welding heat down! The special coating used in Nickel-Arc makes it possible to weld in a lower amperage range, reduces the heat and resulting hard carbides in the weld area. Moreover, Nickel-Arc's AC or Straight Polarity DC operation provides a low-penetrating, easy-to-control arc free of spatter. With Nickel-Arc, therefore, there is always less disturbance in the base metal, and *better machinability* in the line of fusion.

Nickel-Arc's controlled balance between core wire and coating prevents cracking and porosity! Step-by-step control during manufacture maintains this balance. That's why Nickel-Arc produces a dense, sound, ductile weld deposit free from transverse cracks, porosity, and hairline cracks.

Find out how Nickel-Arc can help solve your cast iron welding problems. Order a 10-pound can from your Alloy Rods distributor . . . he has it in 3/16", 5/32", 1/8", and 3/32" diameters.

OVEN FRESH! Packaged in the familiar Alloy Rods red-and-yellow hermetically sealed metal container, every Nickel-Arc electrode reaches you in "oven-fresh" condition.

Alloy Rods Co.

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no finer electrodes made . . . anywhere

THE BEST ROD IS THE CHEAPEST

Avoid duplicate down time costs by giving your wearing parts an overlay of RANITE "A".

You'll find RANITE "A" is easy to apply smoothly, and gives the desired toughness for gears, ditcher parts, shovel pads and tracks, and tractor rails. You have selected the proper hardness (25-30 Rockwell) and can be sure the deposit will NOT work harden and cause brittleness.

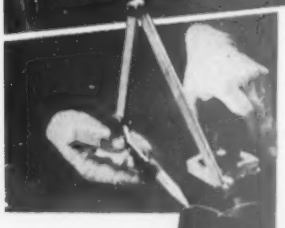
A protective finish pass of RANITE "A" will make those old parts better than new and cost only a fraction of new replacement prices.

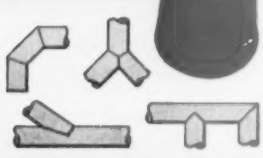
Write for your free copy of Form "A" and Form "A-6" giving simple application details. In conjunction with your RANITE distributor our factory representative will be happy to assist you.

RANKIN MANUFACTURING COMPANY

3072 West Pico Blvd. Los Angeles 6, Calif.

LAY OUT PIPE JOINTS *in minutes!*





SAVE TIME AND MONEY!

A SMOOTH SWING of the Contour Marker's soapstone point and you're ready to cut! It's easy and *absolutely accurate* because there is an angle dial calibrated in both degrees and pitch. Any of the pipe joint angles shown can be marked off in minutes. And you save "man hours" as well as oxygen and acetylene gas because "cut and try" methods are completely eliminated. Two sizes are available complete with adapter for marking structural steel. Standard, for pipes from 1½" to 18" dia.; Jumbo, for pipes from 16" to 48" dia. Instruction book included. Belt case available. Write for information

CONTOUR MARKER CORPORATION OF CALIFORNIA

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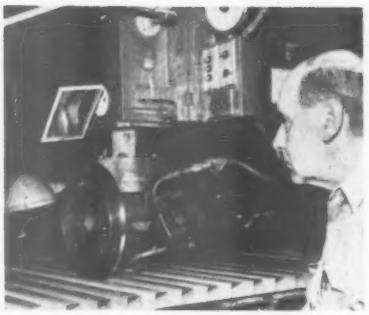
THE CONTOUR MARKER



Mirror on welder effects savings

ADDITION of a mirror to each of the rollweld spot-welding machines at the Seattle plant of Boeing Airplane Co. saves an estimated $15,552 annually in floor-panel operations alone.

The mirror is set at a 45-deg reflection angle to the machine operator so he can see both ends of work at once. Formerly, the operator's distance judgment and neck-craning were the only factors that kept him from overshooting the spot weld strip, which would result in a rejection of the work. The mirror allows the operator to stand in a normal position and watch one end directly and the other end via mirror, reducing fatigue as well as number of rejects. It also reduces by one-third the number of manual tack welds.

* * *

American Chain & Cable opens new L. A. office

DESIGNED to speed up shipments and service to customers in Southern California, Arizona and Southeastern Nevada, a new office has been opened at 2216 S. Garfield Ave., Los Angeles, by American Chain & Cable Co., Inc., Bridgeport, Conn. The 12,000-sq-ft building includes warehouse and manufacturing facilities. Welding rods are among the stock items warehoused.

F. C. Mohr is in charge of production for ACCO's automotive and aircraft division in Los Angeles, and Allen L. Simms, a member of the division's sales department, will serve as office manager of the warehouse.

* * *

G-E to start new plant in Indiana this year

GENERAL Electric Co. will begin construction this year of a new $5,000,000 plant at Shelbyville, Ind., for manufacture of industrial furnaces, induction - heating equipment and heating devices. Actual production is expected to get under way sometime in 1956.

Tests show weldor's mark may cause pipe failure

TESTS by California State Polytechnic college on oil-transmission pipeline welds may result in a change in the current practice of weld identification, wherein the weldor stamps his mark into the pipe on which he works.

Pipe welds rejected in the field have been tested by subjecting pipes to fluid pressure as high as 3,500 psi before they burst. The pipe, donated by a petroleum company, would under normal conditions carry pressures up to 1,100 psi. To date, the pipes have given way along the longitudinal lines of the letters or numbers stamped on them. Richard C. Wiley, welding department head who is supervising the project of three mechanical engineering students, said, "This leads us to believe that sharp, deep impressions in pipe walls are more liable to cause breaks than defective welds themselves." He added that painting or some other method may have to replace identification marks if further tests show same results.

The students—James E. Dearinger, John W. Hughes, Jr., and Gerald H. Schumacher—are also making tests of pipe welds by packing them in dry ice and striking them with a swinging weight. Results will demonstrate effect of temperature variations and sudden blows upon strength of welded pipe joints.

* * *

Arcair Co. acquires new product

ARCAIR Co., of Lancaster, Ohio, and Bremerton, Wash., recently announced acquisition of the manufacturing and distribution of "Meldrum Burner's Aid." The tool, used to adapt gas torches for accurate cutting of circles, bevels and contours, was formerly made by Meldrum Engineering Co., San Francisco. An improved model is now being produced by Arcair and will be advertised as the "Improved Burner's Aid."

* * *

Low-hydrogen electrodes increase production

PUGET Sound Naval Shipyard has reported an increase in horizontal fillet welding production through use of low-hydrogen electrodes, according to a recent article in the Bureau of Ships *Journal*. The increased rate resulted from Type MIL-130 electrode's ability to permit a 1/16-in. smaller weld, rather than from any increase in speed of the weldor.

New "Missing Link"

automatically PROVIDES INERT GAS SHIELDED ARC ON ANY MACHINE

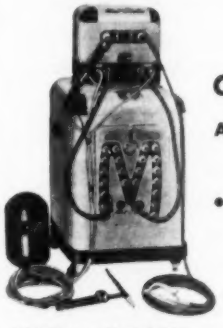
New Model No. 13-D "Missing Link"

New "Missing Link" circuit serves either AC or DC. Needs no auxiliary switch.

The new "Missing Link" No. 13-D, with its advanced-type circuit, converts any arc welding unit into a universal machine *for AC, or DC, inert gas shielded* or metallic arc welding! It is smoother operating and more quiet running than ever. Reduces operator fatigue. And it provides smoother, denser welds.

The 13-D also has continuously variable intensity control . . . precise adjustment for all high frequencies — retaining, of course, outstanding advantages of Mid-States fully automatic gas, water, afterflow and complete operation by remote control.

Send for details today!



Mid-States Model 310, 7-300 amps. with Model 13-D "Missing Link."

Mid-States Arc Welders CUT COSTS with These 7 Features

Automatic Arc Starting • Instant Amperage changes • Welds Ferrous and Non-Ferrous Metals • Unvarying Output, No "Creeping" • No Pressure To Cause Pinholes • No Moving Parts • 100% Penetration — Smoother Beads

ACCEPT Mid-States SIMPLIFIED *WELDING* Brochure *FREE!*

Comes along with "Missing Link" information—complete literature of Mid-States line. Write today!

Mid-States WELDER MFG. CO.

6033 SOUTH ASHLAND AVENUE • CHICAGO 36, ILLINOIS

ARCOS FOR FINEST QUALITY WELDS

Submerged Arc Welding of Stainless with new Arcosite Flux

Now, for the first time, you can apply the economy of submerged arc welding to stainless steels. No longer need you worry about cracking, or poor transfer of the essential stainless elements. The combination of *new* ARCOSITE FLUX and *new* ARCOS CHROMAR (Stainless Steel) WIRE provides a balanced analysis for sound, dependable welds on every job. It's another example of how Arcos experience with coated electrodes and weld metallurgy is being translated into tangible benefits for you.

Write today for the Arcosite Flux Bulletin and see how you may profit from these two *new* Arcos products. Arcos Corporation, 1500 South 50th Street, Philadelphia 43, Pennsylvania.

WELD WITH ARCOS

STAINLESS WIRE AND ARCOSITE FLUX

Use dog to help inspect welds in 20-in. pipeline

"MAN'S best friend" really came in handy recently when a three-year-old dachshund, Fritzie, was beguiled into helping inspect welds on a big gas pipeline in Northern Ohio. No, Fritzie didn't do any inspecting, but the dog did pull a string through 320-ft sections of pipe, which enabled inspectors to pull a crawler with cobalt into the pipe to radiograph the welds.

Pipe sections 40 ft long were welded into the 320-ft sections for a line between Milan and Clyde. The Pipeweld X-Ray Corp., Perrysburg, was retained by East Ohio Gas Co. to inspect the welds. Ordinary X-rays would be too time-consuming, so the firm decided to radiograph the welds with radioactive cobalt.

Since even the smallest man on the job was too big to get through the pipe in a reasonable amount of time, James R. Sapp, general manager of Pipeweld, brought his son's dog to the scene.

While a worker held Fritzie at one end of a section, Mr. Sapp stood at the other end with a wiener and called to the dog. It worked. Fritzie came through that section and others in a hurry, with the string for pulling through the crawler attached to her leash.

* * *

"Miss Weldor of 1954" is Italian actress

AN Italian movie actress was named "Miss Weldor of 1954" by the National Eutectic Weldors' Club at a recent party held in Rome. She is Sophia Loren who was chosen as "the girl we would most like to weld with" by the graduate body of professional weldors attending the welding institute of Eutectic Welding Alloys Corp., Flushing, N. Y.

Miss Loren was officially notified of her selection by Rene D. Wasserman, president of Eutectic, during his visit to Italy. It marks the first time the award was made to anyone outside the United States.

* * *

Welded aerial pipeline passes tests

STRENGTH of welds on the longest aerial pipeline for natural gas in Europe were recently tested by injecting 80 tons of water under high pressure into the line, which is located in Rome. It is built on a special cable bridge about 1 kilometer (3,280 ft) long that crosses the Po river. The work cost about $850,000.

—*McGraw-Hill World News*

New Jersey Distributor opens new building

NEW home of Auto Gas Light & Appliance Co., Inc. and Carbonic Sales Co., Fairview, N. J., distributors of welding supplies and compressed gases, is a modern one-story building at 723 Fairview Ave. It was designed as a store, office, storage and shipping center. The building includes 500 sq ft of office space, 600 sq ft devoted to a stock room that has a large display counter, a 4,000-sq-ft area for storage of cylinders, and a loading platform to accommodate four trucks. An isolated shed is used for other gases, and the firm has 5,000 sq ft of parking space.

* * *

Norton Co. announces new net-pricing program

INSTITUTED to make it easier to buy and sell Norton grinding wheels, a new net-pricing program was recently announced by Norton Co., Worcester, Mass. The new program means that a distributor or customer can determine cost of a grinding wheel, segment, brick, stick or mounted point without resorting to former time-consuming procedures of applying multipliers to tabulated "list" prices to calculate "net" prices.

The change will provide distributors with a rapid means of re-invoicing Norton items. Norton's basic pricing plan has not changed, however, as list prices and multipliers will always be available whenever anyone wishes to check net unit prices.

* * *

McKay laboratory installs hydraulic tester

A NEW hydraulic tester of 300,000-lb capacity has been installed by The McKay Co. in its York, Pa., quality-control laboratories. While this capacity is beyond that normally associated with electrode work, it allows the machine to be used in actual pilot plant work when the weld assemblies may be fitted into the platen areas. In addition to destruction tests, the hydraulic tester is used to bend sample welds for measuring ductility and crack resistance of diluted weld metal under conditions similar to those found in field service.

ARCOS FOR FINEST QUALITY WELDS

Mountains crumble as ***welded*** *jaws bite in*

Modern power shovels gulp truckloads of rock and dirt at one bite. It's a good example of how *welded* high tensile steels make possible bigger payloads—provide extra strength and toughness to reduce maintenance.

An important factor in this achievement is the quality of weld metal. That's why so many fabricators today specify Arcos Low Hydrogen Electrodes when welding low alloy high tensile steels. *On any job* demanding shock and abrasion resistance . . . maximum strength and ductility, the excellent properties of Arcos weld metal assures the results you want in service. Arcos offers quality weld metal and technical assistance that is second to none. Arcos Corporation, 1500 South 50th Street, Philadelphia 43, Pa.

WELD WITH ARCOS LOW HYDROGEN ELECTRODES

YOU GET

ALL 3

WHEN YOU BUY

HARRISBURG OXYGEN GAS CYLINDERS

1. MAXIMUM SAFETY All Harrisburg oxygen gas cylinders for the Welding industry are carefully inspected during each manufacturing operation to meet the high standards of I.C.C. Specifications.

2. MAXIMUM QUALITY The industry's most modern plant, specially designed machinery, specially developed Harrisburg processes, and continual testing assure you of the finest cylinders money can buy.

3. A COMPLETE LINE To meet particular needs, Harrisburg oxygen gas cylinders are built in both Domestic and Export types, with capacities ranging from 14 to 400 cubic feet.

Write for Cylinder catalog and prices.

HSC W 2-54

101 YEARS IN PENNSYLVANIA'S CAPITAL

Harrisburg Steel CORPORATION

HARRISBURG 15, PENNSYLVANIA

British issue booklet on projection welding

"PROJECTION Welding of Mild Steel" is the title of a booklet recently published by the British Welding Research Association, 29 Park Crescent, London. This latest in a series of technical bulletins was prepared by a committee composed of resistance welding experts from the industry in Great Britain.

Recommendations are to be made to cover machines and electrodes, materials to be used, types of projections and machine settings for various thicknesses of material.

—*McGraw-Hill World News*

* * *

Nippes' research for Harrison extended

DR. Ernest F. Nippes, director of welding research at Rensselaer Polytechnic Institute, has been authorized by Harrison Radiator Div., General Motors Corp., to extend to the end of this year his program of research into substitution of aluminum for copper in automobile radiators and other equipment.

* * *

Renner Mfg. Co. starts construction of new plant

Now under construction at 124th St. and Hampton Ave. in Milwaukee is a $250,000 plant which will be the new home of Renner Mfg. Co., fabricator of metal parts for heavy industry. It will contain about 30,000 sq ft of floor space.

* * *

Pier footings

Courtesy Bethlehem Pacific Coast Steel Corp.

SPECIAL rotating jig is used to weld two 60-ft H piles together. They will be used in main pier footings for the Richmond-to-San Rafael (Calif.) highway bridge. Work above is being done at Gilmore Fabricators, Oakland.

TILLMAN Gloves—Garments

WELDORS BUY FROM YOUR DEALER

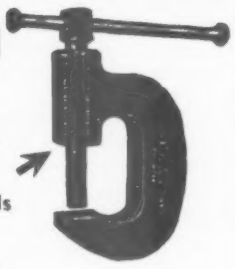
ASK FOR OUR NEW CATALOG

BRAZILIAN DEERSKIN THE "STAY SOFT" LEATHER GLOVES AND MITTENS

TILLMAN PRODUCTS
John Tillman & Co.
Long Beach, Calif.

"Red Head" WELDING CLAMPS

- Designed for Welding
- No Threads To Damage



1. Case hardened threads are always protected from weld spatter and never exposed to damage in open or closed position.

2. The clamp body is cut from solid plate, thereby insuring extreme rigidity and giving great resistance to bending or twisting.

3. Heat treated chrome molybdenum alloy handle offers great resistance to bending.

23 stock sizes

CHICAGO BOILER COMPANY
1968 CLYBOURN AVENUE
CHICAGO 14, ILLINOIS

Navy develops cooling method for repair welding propellers

ACCORDING to the Bureau of Ships *Journal*, the U. S. Naval Engineering Experiment Station, Annapolis, Md., has developed a method for repair welding of silicon-Monel propellers. The procedure was devised in answer to complaints from many Naval activities that major repairs on such propellers failed because welds cracked, and even those with minor welded repairs suffered severe corrosion damage.

Cracks developed because of the "cold short" condition caused by transient thermal stresses. Material used in propellers has low ductility and cannot satisfy the thermal stress development occurring in normal welding procedures.

Here is the successful method in brief: the propeller was cooled to—40 F before welding by packing the blade in dry ice (of the same weight as the blade) and placing it in a special canvas wrapper. Areas adjacent the weld zone were heavily peened before deposition. Monel 130X with 1/8 and 3/32-in. electrodes were used in welding. The deposit was held to 2-in. lengths at a time, and each increment was heavily peened. After each deposition, the flap of the canvas bag was closed, permitting weld zone to cool to—40 F, weld zone peened and next increment deposited.

* * *

Distributor appointments

Air Reduction Sales Co., New York City: Greenville Oxygen Supply Co., Greenville, S. C.

Ampco Metal, Inc., Milwaukee: William M. Orr Co., Inc., Pittsburgh.

Carboloy Dept., General Electric Co., Detroit: Austin Ford Logan, Inc., Buffalo.

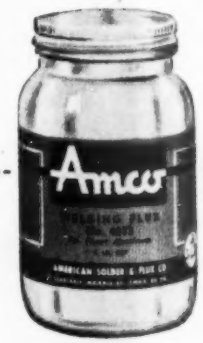
The Rotor Tool Co., Cleveland: Big Three Welding Equipment Co., with offices in Texas, Oklahoma and New Mexico.

Shieldalloy Corp., New York City: Industrial Foundry Supply Co., San Francisco; Gordon Sondraker and Co., Maywood, Calif.

Worthington Corp., Harrison, N. J.: Jackson Welding Supply Co., Rochester, N. Y.; Weldery Supply Co., Jamestown, N. Y.; Mills Welding Supply Co., Buffalo; Maine Oxy-Acetylene Supply Co., Auburn, Me.; Smith Courtney Co., Richmond, Va.; Gulf Welding Co., New Orleans; Delta Oxygen Co., Memphis.

good welding STARTS

with the RIGHT flux



Get stronger welds faster on Aluminum, Stainless and all non-corrosive steels . . . at lower cost, with these AMCO Fluxes.

It's easy to get good welds on every job. Simply select the proper AMCO Flux. Here are two specialized production speeding fluxes.

FOR ALUMINUM: AMCO 4013 effectively dissolves oxides . . . assures thorough, rapid melting and spreading of rod. Prevents reoxidation.

FOR STAINLESS: AMCO 433 completely removes oxides and surface film quickly. Provides a smooth, firm bond. Eliminates reoxidation of rod and base metal at welding temperature.

Welds produced are strong . . . clean. Costs are cut. Get the full story of the many advantages of these fluxes.

● *Tell us your welding problem. We'll recommend the flux. No obligation. Write:*

AMERICAN SOLDER and FLUX CO.

TRENTON AVENUE AT NORRIS ST. · Dept. W., PHILADELPHIA 25, PA.

NOW... *get* ***new***, *reinforced*

NU-TEX

DEPRESSED CENTER

DISK WHEELS

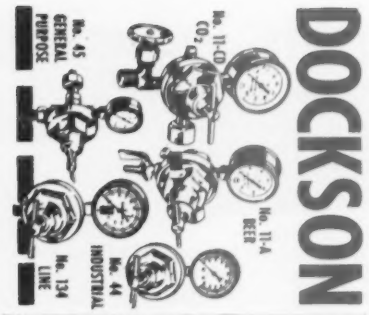
FOR FASTER, SMOOTHER CUTTING, roughing and grinding. Special, built-in resiliency provides smooth, cushioned cutting action . . . reduces bouncing . . . holds wheel in close contact with work. Cushioned action distributes pressure evenly . . . makes every inch of surface travel an inch of productive cutting . . . speeds up work with either portable or bench-type grinders.

FOR LONGER LIFE . . . LOWER COSTS. Bonded together with an extremely tough resin for added durability. Textile reinforcement provides maximum on-the-job safety . . . extra protection against breakage . . . longer life under continuous operation.

FOR A WIDE SELECTION . . . PROMPT SERVICE. Nu-Tex Depressed Center and Straight Disk Wheels are now available in popular diameters and thicknesses for all types of finishing. Grades range from 0 (hard) to 6 (soft). Write for complete details. Atlantic Abrasive Corp., 540 Pearl Street, South Braintree 85, Mass.

ATLANTIC ABRASIVE CORP.

South Braintree 85, Massachusetts



DOCKSON

REGULATORS ... *Built for Better Service!*

STURDY CONSTRUCTION—Forged brass bodies, shatterproof gauges, dependable safety valves.

LOW COST—Replaceable, self-aligning seats; minimum of moving parts.

YOUR DOCKSON DISTRIBUTOR—a selected specialist stocks a complete line of Dockson Products to give you fast service and personal attention. We back our distributors 100%.

WRITE FOR YOUR DISTRIBUTOR'S NAME AND OUR COMPLETE CATALOG OF WELDING AND CUTTING EQUIPMENT

Dockson CORPORATION
3639 WABASH • DETROIT 8, MICH.

ROBERT WILSON has been elected to the board of directors of The Lincoln Electric Co., Cleveland. In charge of application engineering and director of training, Mr. Wilson has been a member of the firm's sales and engineering staff for the past 17 years.

* * *

J. H. HUMBERSTONE has been named president of Air Reduction Sales Co., New York City, succeeding H. R. SALISBURY, who retired June 1. Mr. Humberstone had been president of Ohio Chemical and Surgical Equipment division of Airco in Madison, Wis. He is also a vice-president of the parent firm, Air Reduction Co., Inc. Mr. Salisbury will continue as a director of Airco's foreign subsidiaries—Air Reduction Canada Ltd. and Cuban Air Products Corp. He had been president of Air Reduction Sales since 1949. R. E. LENHARD, formerly vice-president, succeeds Mr. Humberstone as president of the Ohio Chemical and Surgical division.

Humberstone

* * *

Three Worthington Corp. executives were recently appointed to new posts. E. J. TRIBBLE, former works manager of the Harrison, N. J., works, has been named assistant vice-president in charge of manufacturing. He will continue his headquarters at Harrison. A. M. TULLO, former works manager at Wellsville, N. Y., succeeds Mr. Tribble. Mr. Tullo's former post has been filled by L. E. HAMMER, who had been assistant works manager at Wellsville.

* * *

HENRY S. WINGATE, vice-president and director, was recently elected president of The International Nickel Co. of Canada, Ltd. He was also elected to membership on the executive committee and to the presidency of the company's United States subsidiary, The International Nickel Co., Inc. He succeeds DR. PAUL D. MERICA.

HEALTH PROTECTING . . .

"ANTI-BORAX"

CAST IRON

No. 1 WELDING FLUX

Acts as a cleansing agent—removes all impurities in the metal at the weld—prevents formation of oxide—eliminates blow holes—makes possible a better granular, softer, more ductile structure in the weld. Starts melting at 1150°—completes 1275°.

ALSO

2—Brazing Flux for Brass, Bronze, etc.
3—Brass, Bronze Welding Flux
4—Flux for Bronze Welding Cast Iron
5—Extra Quality Aluminum Flux
7—Steel Flux
8—Aluminum Flux
9—Stainless Steel Flux
11—Tinning Compound
12—Burnt Cast Iron Welding Flux
13—Brazing Flux for Extruded Bronzes
14—Special Brazing Flux for Aluminum Bronze, Everdur, and all Silicon Bronzes
15—Special Flux for Magnesium Alloys, Dow Metal, etc.
16—Silver Solder Paste Flux

Profit by the Use of One or More of These Products

Choose the one best suited to your needs and order by number. All ANTI-BORAX Products guaranteed. Send for circular and free sample.

ANTI-BORAX COMPOUND CO., INC.
FORT WAYNE, INDIANA

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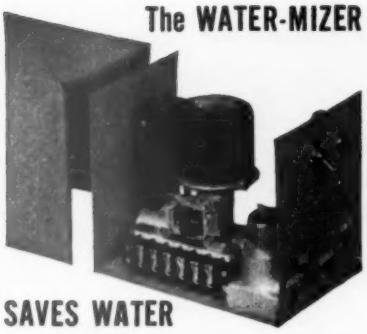
APRONS • BIBS
CAPES • CHAPS
COATS • GLOVES
PANTS • SLEEVES
OVERALLS • SPATS
CURTAINS

WELDERS CLOTHING
for COMFORT, SAFETY, WEAR

The BEST in Welders' protection. Made of finest chrome tanned leather specially treated for heat resistance. Cut full size. Riveted at strain-points. Double stitched. High quality, soft, pliable, made for long hard service.

Write for our CATALOG LISTINGS and low price list "N"

ALJAY MFG. CO. INC.
SPECIALISTS IN WELDERS CLOTHING
1518 CALLOWHILL ST., PHILA. 30, PA.



The WATER-MIZER

SAVES WATER

on resistance welding machines

A complete self-contained unit that automatically controls cooling water. Prevents needless waste . . . cuts down transformer losses . . . reduces excessive mineral deposits . . . decreases sweating, rust and corrosion. The Water-Mizer uses a thermostat control to de-energize the water valve when the machine is idle . . . lets the electrode temperature decide the right time. Dual Flow Control by-pass arrangement allows water to reach the Ignitron Contactor and Transformer. Relay Control system releases water when welding machine is started.

One owner has decreased water consumption from 3800 to only 650 gallons per day. Write for details.

VAN VOOREN PRODUCTS CO.

2133 — 9th Street, East Moline, Ill.

fits 9 out of 10 industrial gasoline engines

•

gives long range speed selection

•

accurate "variable speed" or "constant speed" engine control between 1600 and 2600 RPM

•

Pierce is the most widely used governor for engine-driven welders

•

See your dealer or write to:

THE PIERCE GOVERNOR CO., INC.
1618 Ohio Avenue
Anderson, Indiana

WORLD'S MOST EXPERIENCED GOVERNOR MANUFACTURER

"Oscar" winners Lundgreen (left) and McLaughlin

Two members of the A. O. Smith Corp. sales staff received "Oscars" at the recent meeting of the Milwaukee Sales Executive Club. Winners in the Distinguished Salesmen Award Contest were Sales Engineers C. T. LUNDGREEN, Chicago representative in the central sales region, and B. F. McLAUGHLIN, Cleveland representative in the eastern sales region.

* * *

GEORGE R. FOSTER has been appointed manager of the stainless steel division, general sales department, United States Steel Supply Division. He has been with U. S. Steel since 1943, joining the supply division in 1947.

* * *

J. D. WEBSTER, General Electric engineer, has been transferred to the firm's X-Ray Department in Milwaukee as manager of industrial and non-allied sales. He formerly was a sales engineer in the Apparatus Division's industrial sales department in San Francisco.

* * *

WALTER E. PALMER, former sales manager for All-State Welding Alloys Co., Inc., has been named sales representative for The Champion Rivet Co. (Cleveland) in the New York area. A member of the American Welding Society for more than 20 years, he was associated with Hollup Corp. for 27 years before joining All-State. JOHN R. PATNOVIC has been named sales representative for Champion in the Philadelphia area. Also a member of AWS, he was formerly with Arcway Equipment Co., Baltimore, and Radio Corporation of America.

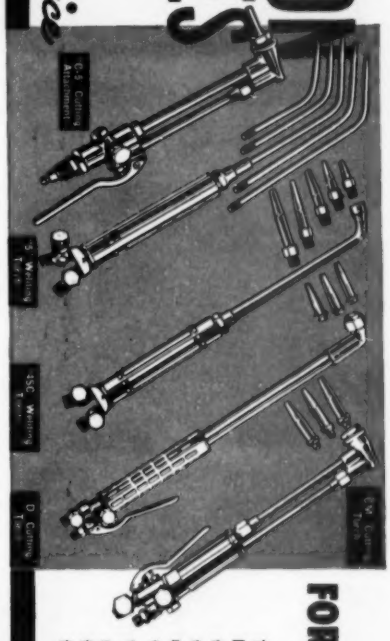
* * *

OLIVER FULLER, formerly of P&H Welder and Excavator Mfg., Escanaba, Mich., has been named to head a new division established by Harnischfeger Corp., Milwaukee, which will handle sales of its electrical equipment. He has been with the firm since 1946.

* * *

DOCKSON TORCHES

Built for Better Service



FOR OXY-ACETYLENE WELDING AND CUTTING

There is a Dockson Better-Built Torch for all your jobs. Dockson Torches incorporate a new, longer life, better seal compound developed especially for oxy-acetylene service in both the mixer and union rings. Dockson's two-ring construction means fewer rings to replace, stronger construction, prevention of possible breakthrough.

Your DOCKSON DISTRIBUTOR—a selected specialist, stocks a complete line of Dockson products to give you fast service and personal attention. We back our distributors 100%.

WRITE FOR YOUR DISTRIBUTOR'S NAME AND COMPLETE CATALOG OF WELDING AND CUTTING EQUIPMENT.

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sellstrom safeguards designed for comfort

SELLSTROM SCARFING MASK DESIGNED TO FIGHT HEAT

The foundry "cleaners" who cut off the gates and risers, and the steel mill "scarfers" who scarf the almost red-hot castings with acetylene torches, are deserving of real protection against the intense heat to which they are continually subjected.

The No. 194 Sellstrom Scarfing Mask here illustrated is ideal for this purpose.

1. It is designed to keep the intense heat away from the face, nose, forehead and chin.
2. Felt on the inside of the nose piece offers an abundance of ventilation while at the same time it prevents breathing in the extreme heat. This is accomplished by a heavy piece of felt on the inside of the nose piece. This is an important new innovation in scarfing masks.
3. The Scarfing Mask is fabricated from sturdy fibre, has the standard Sellstrom adjustable headgear and can be fitted with 50 m/m lenses of any required density.

This Scarfing Mask is of extraordinary quality, designed for hard use in foundries and steel mills and will give long, satisfactory service.

Ask your dealer about the Sellstrom No. 194 Scarfing Mask. If he cannot supply you, write us direct for additional information. Or better still, let us forward a sample Scarfing Mask on memo for your inspection.

sellstrom
MANUFACTURING COMPANY

Eye and Face Safeguards Designed for Utmost Comfort

626 N. Aberdeen Street Chicago 22, Ill

DR. DAVID ROZET, who for the past three years was vice-president and director of research with The Weldwire Co., Inc., Philadelphia, has severed his connection with that firm.

* * *

H. F. HUTTEMEYER has been appointed to the newly created post of director of production at Pennsylvania Optical Co., Reading, Pa. He was formerly director of sales at L. J. Houze Convex Glass Co., Point Marion, Pa. He has also been associated with American Optical Co. and Good Grooming Products Co. Mr. Huttemeyer will be in charge of production throughout the entire Pennsylvania Optical plant.

Huttemeyer

* * *

ROBERT T. FOX, district engineer for Eutectic Welding Alloys Corp., Flushing, N. Y., has been promoted to district manager. He joined the firm in 1946 to service and develop the areas of Manhattan and Long Island City. He will now supervise the five boroughs of New York City as well as Nassau, Suffolk and Westchester counties and Union and Hudson counties in New Jersey.

* * *

Assignments of the following four application engineers were recently announced by The Lincoln Electric Co., Cleveland: ROBERT CLIPSHAM, to Kansas City; GORDON COLLIER, to the Philadelphia district; JOHN GONZALES, to the Columbus district; DONALD HASTINGS, to the West Coast Emeryville district.

* * *

RICHARD H. SAWYER has been assigned to open a new engineering sales district in Birmingham, Ala., for KSM Products, Inc., Merchantville, N. J. Office for the new district is at 1727 Sixth Ave. Mr. Sawyer was formerly with Hays Supply Co., Memphis distributor for KSM.

* * *

HUGH T. PRICE, JR., was recently made factory manager of Norton Co.'s grinding machine division. He succeeds IVER G. FREEMAN, who became vice-president of Reed-Prentice Corp. ROLAND T. NELSON replaces Mr. Price as production manager, and OSCAR A. ERICKSON succeeds Mr. Nelson as planning engineer.

25 FLUXINE Fluxes

The result of over 50 years of scientific research. One for every welding, silver soldering, brazing, and soft soldering operation . . . each with its own properties, designed for a particular metal-joining operation. No injurious fumes.

No. 43 FLUXINE —non-glaring for low-melting silver solders. No injurious fumes.

NO. 7 FLUXINE —for welding all types of aluminum, aluminum alloys and Dow Metal.

No. 28H FLUXINE for gas, hydrogen, or heliarc welding of stainless steel and inconel.

No. 47 FLUXINE —for silver soldering aluminum bronzes, beryllium copper and brass.

No. 18C FLUXINE for gas welding of stainless steels, inconel and nickel chrome alloys.

Write on company letterhead for chart and generous sample stating which FLUXINE desired.

KREMBS & COMPANY
(Est. 1875)
Dept. J, 669 W. Ohio St., Chicago 10, Ill.

We mean the tips on those new Smith's Welding Torches. They swivel to any angle you want while flame stays burning! You don't need to shut off gas or stop your work: Just turn the tip to a new angle and away you go!

Drop us a card — we'll tell you more.

SMITH WELDING EQUIPMENT CORPORATION
Dept. WE-101 2633 S. E. 4th St. Minneapolis, Minn.

Kibbey

Colwell

HAL P. KIBBEY has been appointed assistant vice-president, sales, of United States Steel Supply Division. He formerly was Chicago district manager of the coast-to-coast warehousing division of U. S. Steel. CLYDE B. COLWELL, JR., formerly district manager at St. Paul, succeeds Mr. Kibbey in Chicago. EARL SIMANEK, who was assistant district manager in Chicago, succeeds Mr. Colwell in St. Paul. WARREN F. HJERPE was appointed to succeed Mr. Simanek.

* * *

L. D. RICHARDSON has been appointed national sales and service supervisor by Eutectic Welding Alloys Corp., Flushing, N. Y. His duties include supervision of sales, sales training and service in the United States and Canada. Before coming to Eutectic nine years ago, Mr. Richardson was chief welding engineer for the prime contractor on the Manhattan Project at Oak Ridge, Tenn. He is a member of AWS and ASM.

* * *

J. K. BELL is now the head of the non-destructive testing department of Sam Tour & Co., Inc., New York City. He is a member of the American Welding Society as well as of The Society for Non-Destructive Testing.

* * *

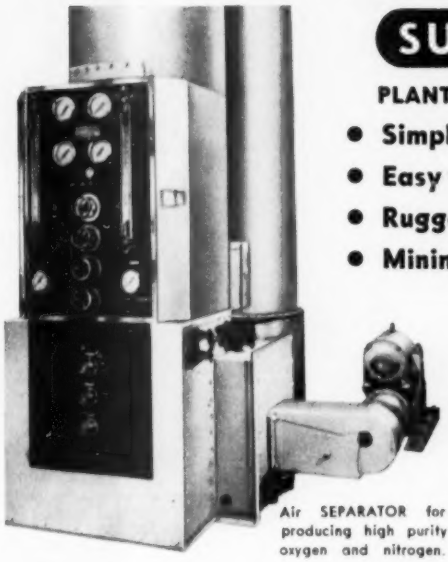
Westinghouse Electric Corp. recently made the following appointments at its Aviation Gas Turbine Division, Philadelphia: REINOUT P. KROON was named director of research, and EDMUND C. SEDLACK was appointed administrative assistant to the division manager.

* * *

Died . . .

DR. WENDELL F. HESS, director of research at Rensselaer Polytechnic Institute since 1952, died April 21 following a heart attack. He was 51. Dr. Hess was also head of the Troy, N. Y., school's department of metallurgical engineering. He was recognized as an international authority on welding, particularly in the field of electrical resistance welding.

Oxygen-Nitrogen from Air



Air SEPARATOR for producing high purity oxygen and nitrogen.

SUPAIRCO

PLANTS AND APPARATUS

- Simple to install
- Easy to operate
- Rugged construction
- Minimum maintenance

We have installations all over the world. Let us know your requirements. We will be glad to furnish detailed specifications and prices.

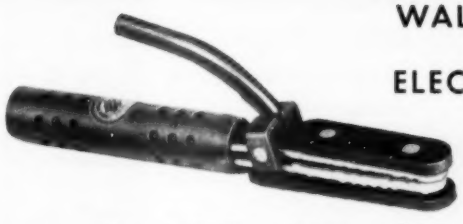
SUPERIOR AIR PRODUCTS CO.

130 Malvern St. Newark, N. J., USA

Also manufacturers of plants for producing liquid oxygen—liquid nitrogen—liquid air also Storage and Transport Containers for all liquefied gases.

BETTER WELDING LOWER COSTS

W-AL-CO PRODUCTS



WALCO - DETROITER IMPROVED ELECTRODE HOLDER

With the Streamlined Trigger

- Same rugged construction
- Double life reversible insulation
- Adjustable jaw tension
- Cooler handle
- Both jaws carry current from cable to rod

	Model	Rod Capacity	Amperage	Weight
Medium Duty	300 VRI	1/6 to 1/4	the lowest best suited for the type and size of electrode used.	20 oz.
Heavy Duty	400 VRI	1/6 to 5/16		24 oz.

WALCO GROUND CLAMP

AN A. H. J. WAGNER PRODUCT

This is the Ground Clamp that keeps the work going steadily. No time out for repairs. No delays. No maintenance costs. Weak spots have been eliminated. A "must" where you want the best results.

PATENTED CABLE FASTENER PREVENTS CABLE BREAKAGE

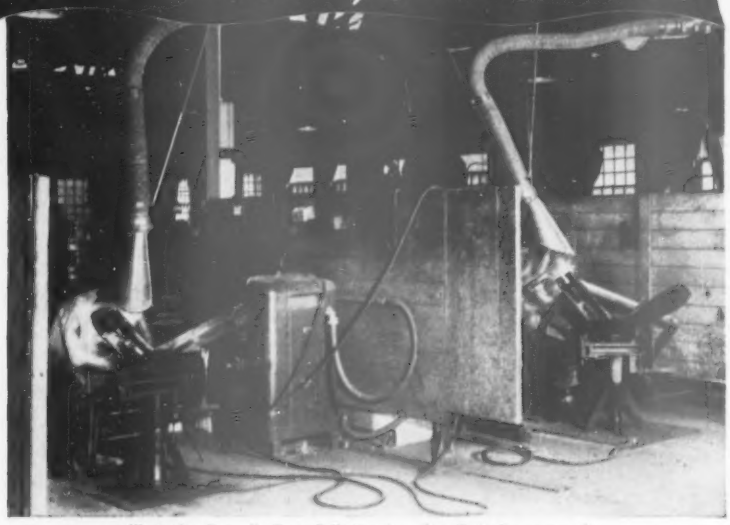
All mechanical joints. No solder—no weakness.

WELDING ALLOYS MANUFACTURING CO.

Sales Office: 744 Broad St., NEWARK, N. J. Tel. MArket 3-2532

Plant: MALDEN 48, MASS.

RUEMELIN *Welding Fume Collectors*



Illustrating Ruemelin Fume Collectors in action. Part of a group of sixteen collectors at plant of Sterling Wheelbarrow Co., Milwaukee.

Collects fumes at the source! Counterbalanced inlet hood stays in working area automatically. Hoods have great lateral and vertical range for table, positioner or floor use. Thousands in every day service. Write for bulletin 37-E.

RUEMELIN MFG. CO.

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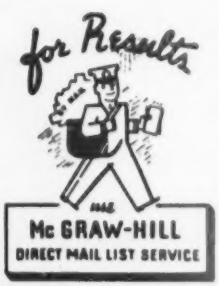
Do it now! The best advertising programs are planned well in advance.



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Welded bridges

COMPARATIVE BRIDGE DESIGN. Edited by James G. Clark. Published by James F. Lincoln Arc Welding Foundation, Cleveland, 1954. Cloth, 6 by 9 in., 211 pages. Price $2.

How the use of welded design in bridges will lead to a significant saving in material and money is illustrated in this volume which presents designs by leading bridge designers in the United States. These designs were entered in a recent award program sponsored by the James F. Lincoln Arc Welding Foundation.

The welded bridge designs are of comparable existing or proposed riveted bridges. In order to cover as many types of bridges as possible, Mr. Clark has selected only important details from the outstanding entries and compares welded and riveted designs. Original comments by the designers are included to explain how the welded designs realize important savings in material and time.

The bridges studied include all of the major types in varying lengths. They include: continuous girder bridges, with and without floor beams; prestressed girder bridges; simple beam spans; simple trusses; continuous trusses and arches.

* * *

Titanium data

TITANIUM AND TITANIUM ALLOYS. By John L. Everhart. Published by Reinhold Publishing Co., New York City, 1954. Cloth, 4 by 6½ in., 184 pages. Price $3.

Information intended for the engineer or designer interested in the possibilities of applying titanium in the solution of his problems is presented in capsule form in this volume. Sufficient data on production is included to indicate effects of melting methods on the properties of titanium. Properties of the pure metal are covered briefly merely to furnish a background for a discussion of commercial materials.

In the chapter on joining there is a discussion of the various welding methods used in the fabrication of titanium; namely, arc welding, resistance welding, cold welding, brazing and soft soldering.

30 YEARS AGO

(Taken from THE WELDING ENGINEER *of July, 1924)*

METALLIC arc welding is discussed in this issue by C. J. Holsag, chief engineer of Electric Arc Cutting & Welding Co.

—30 YEARS AGO—

THE many different and profitable ways that large industrial firms on the Pacific Coast use the oxyacetylene torch are described in this issue by C. W. Geiger.

—30 YEARS AGO—

CARNEGIE Institute of Technology, Pittsburgh, has established a special research bureau of metallurgy. It will begin its work in September of this year.

—30 YEARS AGO—

METHODS of protecting eyes and bodies of arc-welding operators are discussed in this issue by D. H. Deyoe, of the Industrial Engineering Department, General Electric Co.

—30 YEARS AGO—

JAMES W. DUNHAM, son of M. Keith Dunham, of Oxygen Products Co., Chicago, sailed for Germany last month.

—30 YEARS AGO—

THE Autogenous Co. is the new name of the former Autogenous Welding & Machine Co., Baltimore.

—30 YEARS AGO—

FRANK C. ANDERSON, of International Oxygen Co., Newark, N. J., has returned to New York after a business trip to the West.

—30 YEARS AGO—

UHLIR Welding Co., Beloit, Wis., is remodeling a building at 622-624 Cross St., which will double the floor space.

—30 YEARS AGO—

LEAD editorial in this issue, entitled "Safety or Sorrow," stresses safe handling of cylinders, generators, castings and machinery.

—30 YEARS AGO—

"COURSE in Electric Welding" is the title of an article in this issue that describes General Electric Co.'s school for training weldors at its Schenectady, N. Y., plant.

—30 YEARS AGO—

SEVERAL manufacturers of welding equipment and gas products were among the exhibitors at the American Railway Association show in Atlantic City, N. J., last month. The exhibit coincided with the annual convention of the Gas Products Association.

AT THE FRONTIERS OF PROGRESS YOU'LL FIND

AN AIR REDUCTION PRODUCT

FOR WELDING AND CUTTING...

IN THE RED DRUM

HIGHEST QUALITY

DUST-FREE

NATIONAL CARBIDE

Write for the name and address of the NATIONAL CARBIDE supplier nearest you.

National Carbide Company

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A DIVISION OF AIR REDUCTION COMPANY, INCORPORATED

Are REJECT WELDS killing your profits?

avoid scrap loss, reworks with DryRod Electrode Oven!

Engineers say most defects in high-strength welds — X-ray porosity, rough welds, underbead cracking, etc. — are caused by moist electrodes. DryRod — the original shop-tested circular electrode oven — safely preserves the manufacturer's "baked-in" quality . . . keeps rods within the .2% moisture limit allowed. Protect yourself against costly rejects, reworks, scrap loss . . . preserve electrodes conveniently, at low cost, with DryRod. Write for free bulletin.

Type 300 Oven

Automatic thermostatic control, 175 to 550° . . . holds 350 lbs. of 18" rods . . . safe, adequate 840-watt heater . . . completely wired for 110/220 or 220/440 volt AC . . . sturdy welded-reinforced sheet metal construction . . . insulated — low heat loss, low upkeep.

DryRod—Trademark X-DR-13

Cut costs 4 ways with DryRod Method

1 Store sealed cartons in warm, dry place.

3 Locate DryRod as close to welding operations as possible.

2 Place unpackaged electrodes in DryRod Oven and withdraw as needed.

4 For flexible, large-volume storage, stack ovens with compact DryRod Stands.

DryRod DIVISION OF Phoenix Products Co. 4715 N. 27TH ST. MILWAUKEE 16, WIS.

Americans Are Rolling Up Their Sleeves!

YES, ALL KINDS OF PEOPLE ARE GIVING BLOOD SO THAT OUR WOUNDED MAY LIVE!

• Today, the blood of a Boston bookkeeper may be flowing through the veins of a wounded kid from a Kansas farm... the blood of a pretty Southern housewife may have saved the life of a grizzled leatherneck. For, blood is blood, a God-given miracle for which there is no substitute . . . and when a man's life hangs in the balance and blood is needed, there is nothing else to take its place!

Right now the need for blood is urgent. In hospitals —at home and overseas— many men require four and six transfusions during delicate operations. And the blood *must be there*—when it's needed. So give the most precious gift of all—*your* blood!

Be assured that giving blood is neither difficult nor distressing. And what a thrill there is in knowing that you've performed a really unselfish act! So call your local American Red Cross today and make an appointment. And tell your friends and neighbors about your experience. Let them share the wonderful feeling Americans get when they roll up their sleeves—and give blood.

But—

WHAT HAPPENED TO THAT PINT OF BLOOD YOU WERE GOING TO GIVE?

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- ALUMINUM SOLDER—for cast or drawn aluminum and die-cast metal
- MOULDOUGH—for backing up job to weld against
- BRAZING FLUX NO. 10—for brazing all metals
- SPECIAL NO. 31—cast iron brazing flux
- SEAL-X-O—for filling pin holes in electric welds
- CAST IRON WELDING FLUX NO. 4—also All Steel Wire Brushes and Rod Holders

Try them yourself—find out why they are so widely used. Our handy-size catalog will give you helpful advice—send for it!

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WAGNER
ELECTRODE HOLDERS

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— Engineering at its Best!
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- "STREAMLINE" — Low center of gravity trigger for quick one-hand rod release — saving time in production WELDING.
- HIGH HEAT RESISTANCE — Glass fiber insulation for Jaw covers give greater strength with longer life.
- WAGNERLOY — High Arc Resistant copper alloy used in tong members.
- CHANNEL CONSTRUCTION — In tong members for more rapid heat dissipation.
- SPRING TENSION ADJUSTMENT — for proper rod grip and ease of spring replacement.

WAGNER MFG. CO.
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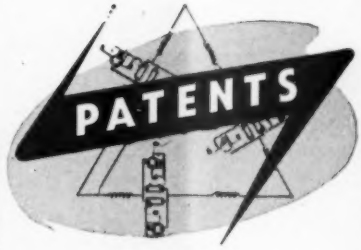
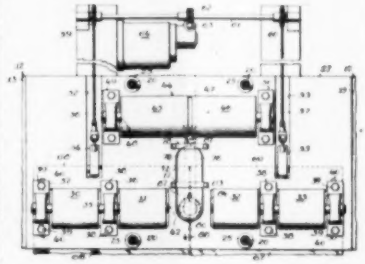
Weld with Wagner



Butt welder

2,666,834. CHESTER MOTT, Evanston, Ill., deceased, GEORGE A. MOTT, Evanston, executor. Assigned to Fansteel Metallurgical Corp. Filed June 24, 1952. Granted Jan. 19, 1954.



A machine for butt welding metal sheets is the subject of this patent. The sheets to be welded lie between a flat stationary plate and a floating plate that is resiliently supported above the former. Rollers are carried by the latter plate, which has cutouts through which the roller portions may extend for bearing against the top surfaces of the sheets. The axes of the rollers are perpendicular to the line of butt welding. A welding means is secured to the floating plate, which also has a cutout at the weld region that provides access of the means to the work. Another means guides two metal sheets between the plates so that the edges to be butt welded pass under the welding means.

* * *

Soldering flux

2,664,370. CHESTER A. SNELL, New York City, JACOB M. FAIN and JOHN A. DE ROSA, Brooklyn. Assigned to the U. S. Army. Filed Dec. 20, 1951. Granted Dec. 29, 1953.

A soldering flux is the subject of this patent. The flux consists of about 10 to 12% by weight of a boron trifluoride addition product of an amine selected from the group comprising diphenyl amine, diphenyl guanidine and phenyl diethanol amine; 3.5 to 8% by weight of tetrachloro-naphthalene; 55 to 75% by weight of a resi selected from the group consisting of rosin, hydrogenated rosins, rosin modified maleic ester resins and abietic acid; and 10 to 30% by weight of a glycol ether.

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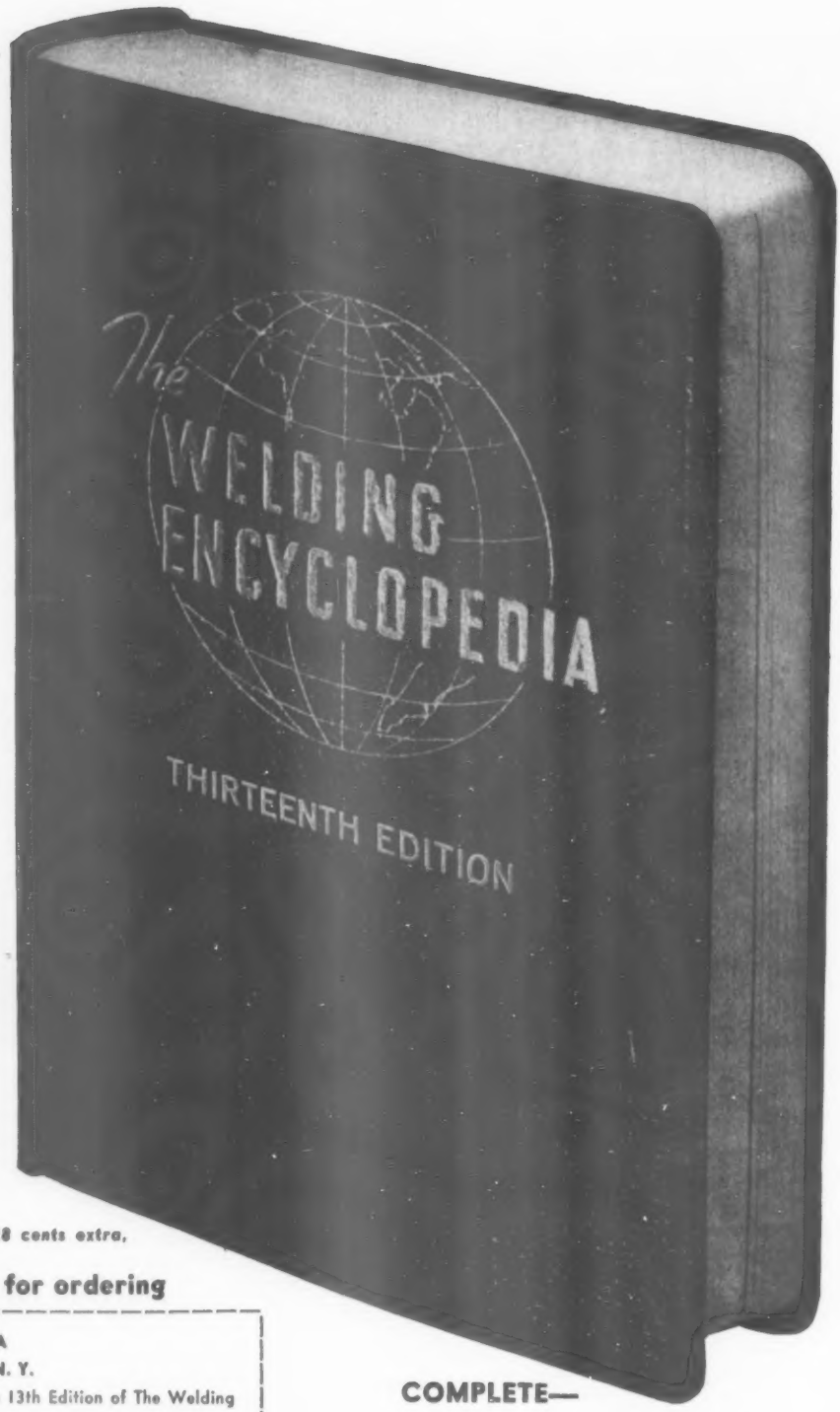

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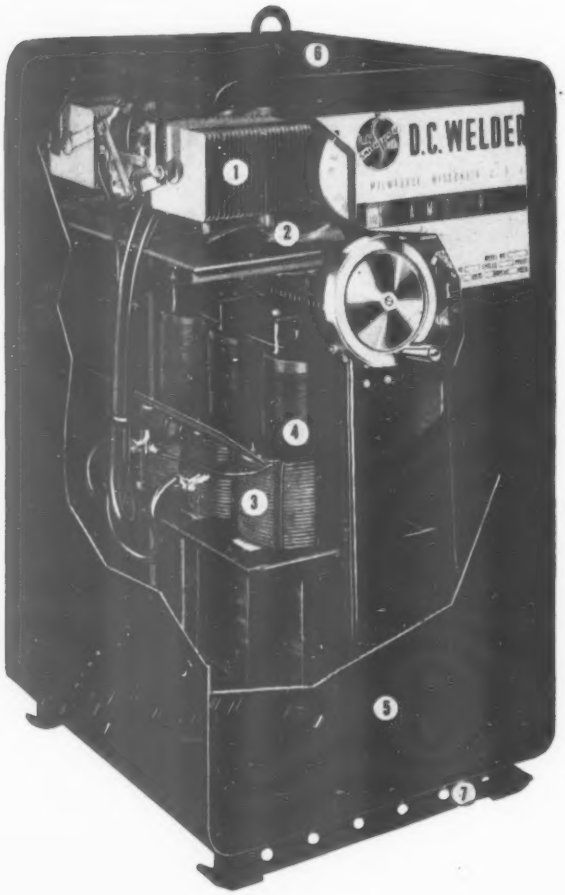

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